

A SIMULATION/PRESENT VALUE APPROACH TO
THE EVALUATION OF ALTERNATIVE METHODS FOR
FUNDING EXECUTIVE BENEFITS PROGRAMS

A THESIS

Presented to

The Faculty of the Division of Graduate
Studies

By

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In Partial Fulfillment
of the Requirements for the Degree
Master of Science in the School of Industrial
and Systems Engineering


Georgia Institute of Technology

March, 1976


31-3
T-254

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Date approved by Chairman: 3/15/76

ACKNOWLEDGMENTS

I want to express my most sincere gratitude to Dr. Thomas Clark, my Thesis Advisor, for all his assistance, guidance and recommendations during the development of this work.

I would also acknowledge Drs. L. F. McGinnis and R. D. Wright, who served on the reading committee.

To Don York, from Balser, McCamish & Co. appreciation is extended for supplying pertinent information.

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CHAPTER I

INTRODUCTION

1.1 Statement of the Problem

Consider the case of a company with a relatively small (≤ 50) executive group. The company provides various death, disability, and retirement benefits to its executives as a part of their total compensation. Thus, the company has committed itself to future cash outflows whose exact amounts and times of occurrence cannot be known with certainty.

The company may consider several methods for funding these cash outflows using various combinations of life and disability insurance. These methods may range from no insurance at all to full coverage of all possible death and disability contingencies. Each alternative funding method will introduce a new set of cash outflows (insurance premium and personnel benefit payments) and inflows (insurance benefits) for the company.

In deciding which funding method to use for any given set of executive benefits, two criteria would seem to be of prime importance:

1. The expected present value of the cash flows after taxes for each method; that is, an aggregate cost on the average adjusted for the time value of money.

2. The pattern of possible cash flows after taxes to which the company is exposed over the years for each method; that is, a picture of cash flow risks over time.

The research reported herein involved the development and application of the methodology to address a real world problem of this type. In doing so, the necessary data were provided by Balser, McCamish and Company, an insurance agency in Metropolitan Atlanta.

1.2 General Methodology

Because of the many probabilistic factors involved in such a case, simulation seemed to be a useful approach for the development of the two evaluation measures suggested above. The simulation model contained descriptions of:

1. The executive group in terms of their ages, salaries, etc.
2. The death, disability, and retirement benefits offered by the company in terms of the conditions under which they will be paid and how the size and duration of the payments will be determined.
3. The particular insurance plans to be evaluated in terms of premium schedules, dividends, cash value accumulations, benefits, etc. Only one plan would be contained within the model at any given time.

In addition, the model contained data describing the probabilities of death, disability, resignation, and retirement of the individual executives, recognizing that these probabilities change over time.

Using a computer, the model simulated the behavior of the system over a period of years. Within each simulation run, the sequence of events was determined stochastically, based upon the probabilities built into the model. The cash inflows and outflows that occurred were recorded by year and their present values were accumulated. Thus, at the end of one simulation run, the model had generated a pattern of cash flows over the simulated years and the total present value of those cash flows.

Several simulations were run based upon exactly the same initial conditions, but with different random sequences. The events that occurred and their resulting cash flows differed from one simulation to another due to the probabilistic nature of the model. After many simulations had been run for a given benefit funding method, a distribution of cash flow patterns and present values had been generated for that particular funding method. The expected present value for the plan was then calculated as the mean of the distribution of present values generated by the model. It was also possible to examine the patterns of cash flows over simulated years. Thus, the two criterion measures (expected present

value and cash flow risk) were developed for that particular funding method.

In similar manner the same two criterion measures were developed for all other funding methods that were of interest. This information is of great value in decisions concerning which funding method to employ for a given set of executive benefits.

1.3 Literature Survey

A search of the literature indicates that personnel and financial executives recognize the need to develop better methods for dealing with the complex decisions concerning long range funding of personnel benefit programs. A paper by Charles D. Ellis (3), emphasizes the need for long term strategic planning in pension fund administration. The conclusion of the paper states:

Pension fund administration is a senior management responsibility that should not be passively delegated to outsiders who are prepared to deal with only part of the problem. Although actuaries can help quantify and project the annual dollar consequences of various changes in pension benefits and although investment managements can help increase the average rate on invested pension funds assets, only senior corporate management knows enough about the future of the company and its compensation philosophy to lay out the basic elements of an effective pension strategy..... Pension assets and funding are too important to business, to employees, and even to our national goals to be handled on an ad-hoc basis with only near-term planning horizons. Fulfillment of corporate and fiduciary responsibility over decades ahead will

require both careful financial planning and vigorous investment management to make pension assets truly productive capital [3, p. 56].

There is a need, then, to reflect the forecasts of year-by-year "cash flows" that can be expected under a specific compensation plan to determine with a cost/benefit analysis which one is or can be the best option to fund it.

A computer simulation is an appropriate instrument for handling this problem. Forecasts of income and expenses under various conditions can be generated for extended periods of time. Cash flows for different funding methods can be reduced to present value for comparison using an appropriate rate of interest.

Forecasting techniques can provide "most probable" projections and hence can cover the "most likely" situation. But one definition of "most probable" is that there is an equal likelihood that actual experience will be either more or less favorable, company costs will be less and no problems will arise; but if experience turns out to be less favorable, from a financial point of view, additional unexpected costs would be incurred [2, p. 130].

Preston C. Bassett has provided an example of the application of simulation to generate cash flows associated with personnel benefit plans (2). Bassett's model considers the pension benefit plan for an hypothetical XYZ corporation (see Appendix A). To value the pension plan, the company

will invest in different options: short and long term investments, and the return obtained will be used to pay the retirement benefits. To estimate the present cost of this pension plan, it is necessary to obtain the current value of all the future disbursements and then spread this cost over the future working year of the participants. With payments deferred for many years in the future, the effect of the rate of return on invested money is substantial [2, p. 128].

Basset's sample included active, disabled, and retired people. Assumptions in his analysis included the following:

1. Short-term investment, which are liquid investments for less than three years, will earn 5% interest.
2. All other investments will earn 9%.
3. Inflation and productivity increases will account for a rise of four percent per year in salaries.
4. Merit increases in salaries and wages for each employee category will occur at rates extrapolated from prior experience.
5. Turnover will occur at rates based on prior experience.
6. Mortality rates will conform with rates set forth in tables prepared by the Society of Actuaries.

Exhibits for cash flows were given for the following situations:

- a) No entry of additional participants (see Figure 1).
- b) Constant work force with entry of new participants to replace those eliminated by attrition (see Figure 2); that is, the change in personnel is taken as a factor that can generate a different behavior.

Comparing both figures, the cash flows for the benefits will not peak until after 30 years even though the active work force has been held constant. Also, it can be seen that total payments begin to increase sharply in the early 1980's, an effect that can be traced to the assumption that inflation and productivity will cause salaries to grow at 4% annually.

An exhibit (see Figure 3) showing the projected total pension payments up to the year 2002 and the payroll for the same period is very useful for the employer because it gives him a perspective on how he ought to level out the cost of providing pensions over the long run, given his assumptions about the future [2, p. 129].

In general the success of the pension forecast depends on involving all the people inside and outside the company who either can provide valuable inputs or have a vital interest in the results of the forecast.

The investment adviser should work with the actuary and with those in the company concerned with the financial

Year	Retired employ- ees & benefici- aries	Terminated employees with vested benefits over 65	Disabled employees	Total
<hr/>				
1972	\$ 994	\$ 18	\$ 34	1,046
1973	1,130	20	56	1,206
1974	1,317	22	79	1,418
1975	1,517	22	102	1,641
1976	1,632	24	122	1,778
1981	2,622	39	233	2,894
1991	5,204	259	430	5,893
2001	6,985	648	468	8,101
2011	6,745	789	302	7,836
2021	3,176	399	87	3,662
2031	807	102	10	919
2041	72	9	0	81
2051	0	0	0	0

Figure 1. Forecast Payments to Current Participants
(in thousands of dollars). [2, p 128].

Year	Retired employees & beneficiaries	Terminated employees with vested benefits over 65	Disabled employees	Total
<hr/>				
1972	\$ 994	\$ 18	\$ 34	\$1,046
1973	1,130	20	56	1,206
1974	1,317	22	79	1,418
1975	1,517	22	102	1,641
1976	1,632	24	122	1,778
1977	1,798	28	144	1,970
1982	2,775	42	254	3,071
1987	4,054	86	373	4,513
1992	5,562	256	497	6,315
1997	7,202	495	618	8,313
2002	8,751	660	793	10,204

Figure 2. Forecast Payments to Current and Future Participants, Assuming Constant Work Force (in thousands of dollars). [2, p 129].

Year	Payroll	Pension payments	Payments as a per- centage of payroll
1972	\$ 39,544	\$ 1,046	2.64 %
1973	41,835	1,206	2.88
1974	44,174	1,418	3.21
1975	46,304	1,641	3.54
1976	48,937	1,778	3.63
1977	51,507	1,970	3.83
1982	66,224	3,071	4.64
1987	83,795	4,513	5.39
1992	105,018	6,315	6.01
1997	130,324	8,315	6.38
2002	161,008	10,204	6.34

Figure 3. Forecast of Growth of Payroll for XYZ's
Plan, Assuming a Constant Active Work Force
(in thousands of dollars). [2, p 129].

aspects of the pension plan. Together they will try to reach a conclusion on the rate of return on investment needed to convert an employee's pension benefits payable during retirement to company costs.

So far as XYZ was concerned, the consensus was to invest 20% of the portfolio in short term liquid investments bearing 5% and the other 80% in longer term investments bearing 9% [2, p. 130].

There are some limitations of Bassett's work:

1. It is an aggregate simulation; cash flows are shown for all the employees as a group.
2. The number of runs done to get his conclusion are not specified, the exhibits could be the result of just one or the average of many.
3. He does not deal with insurance.

Bassett's conclusion states:

Each organization calls for individual analysis. Not only will its pension plan, fund, and employee data be different from others, but each organization may well arrive at different decisions as to what variations are likely to occur.

In addition each will want to price out different types or combinations of changes or amendments to its present plans.

The end result will give a company's management valuable information about its true pension plan itself. Financial officers will receive excellent projections of short - and long term costs. For the first time, probably, the company will be able to factor realistic pension costs into its overall financial projections. Administration can be more efficient, and both company and beneficiaries will benefit from that [2, p. 134].

A procedure for cost/benefit analysis of executive benefit plans has been presented by George Hettenhouse (6). The procedure involves the calculation of the after-tax present value cost to the company providing a given after-tax present value benefit to the executive. By repeating this procedure for each pay package, one can identify both the relative costs of providing a given reward and the relative rewards possible for a given cost.

Hettenhouse's paper presents an analysis of different methods of funding a compensation policy to satisfy the executives and stockholders simultaneously.

In his paper Hettenhouse analyzed four different compensation plans (see Appendix B). Implementation is more easily accomplished where changes in the composition of pay packages are not forced on the management group. Pay increases can be offered in a manner that allows each executive to select the plan that best suits his individual needs without affecting the net cost to the employer. This "supermarket" style compensation has been considered in recent years by different companies.

Under the strategy, the company first decides how much cost it is willing to incur to reward a particular executive. For typical cost choices see Figure 4 [6, p. 123].

The executive is then free to select the plan which best accords with his individual and tax circumstances, allowing

A Series of Equal Cost Compensation Alternatives

In this company, an executive aged 50 may select additions to his compensation package from the following choices where each alternative described costs the company \$100 after taxes.

Alternative	Amount
Cash bonus	\$192.30
Deferred bonus	\$50.60/year for the next five years.
Fringe benefit	Replacement value of \$240.40 to the executive
Group life insurance	An additional amount of one year term insurance of: a. \$14,828, if total coverage is currently less than \$50,000; or b. \$17,673, if total coverage is currently greater than \$50,000.
Deferred pay contracts:	
Single payment at retirement	\$748.50 paid in a lump sum at retirement
10 payments in retirement	10 annual installments of \$94.45 paid during the first 10 years following retirement.
Qualified pension plan	Increase in the pension annuity of \$47.20 per year
Qualified profit-sharing plan	\$192.30 paid to the profit-sharing trust on the employee's behalf; employee selects settlement option.
Qualified stock option	Employer grants sufficient shares so that the expected price appreciation over the exercise period is \$162.80.
Nonqualified stock option	Employer grants sufficient shares so that the expected price appreciation over the exercise period is: a. \$313.10, if the option is exercisable for 5 years; or b. \$508.10, if the option is exercisable for 10 years.
Restricted stock plan	Employer grants restricted shares at a total discount of: a. \$192.30, if the employee plans to elect current taxation; or b. \$311.90, if the employee plans to defer taxes until the restrictions lapse

Figure 4. A Series of Equal Cost Compensation Alternatives [6, p. 123].

him to maximize his after-tax monetary reward [6, p. 124].

In his conclusion, Hettenhouse makes a very important statement:

The value of this type of analysis lies in the fact that cost savings can be obtained at "no loss" in the value of the reward actually realized by the executive. In my experience, efficiency of the pay package does not appear to have been an important consideration in formulating the means for rewarding top executives [6, p. 121].

However, Hettenhouse's paper does not implement simulation techniques and the strategy proposed is the reverse of the one ordinarily pursued, where the company first decides on a compensation reward appropriate for a given executive and then selects a compensation plan which minimizes the cost of providing him with that reward.

Communications with experts in the insurance field and an extensive research of literature indicated no other published examples.

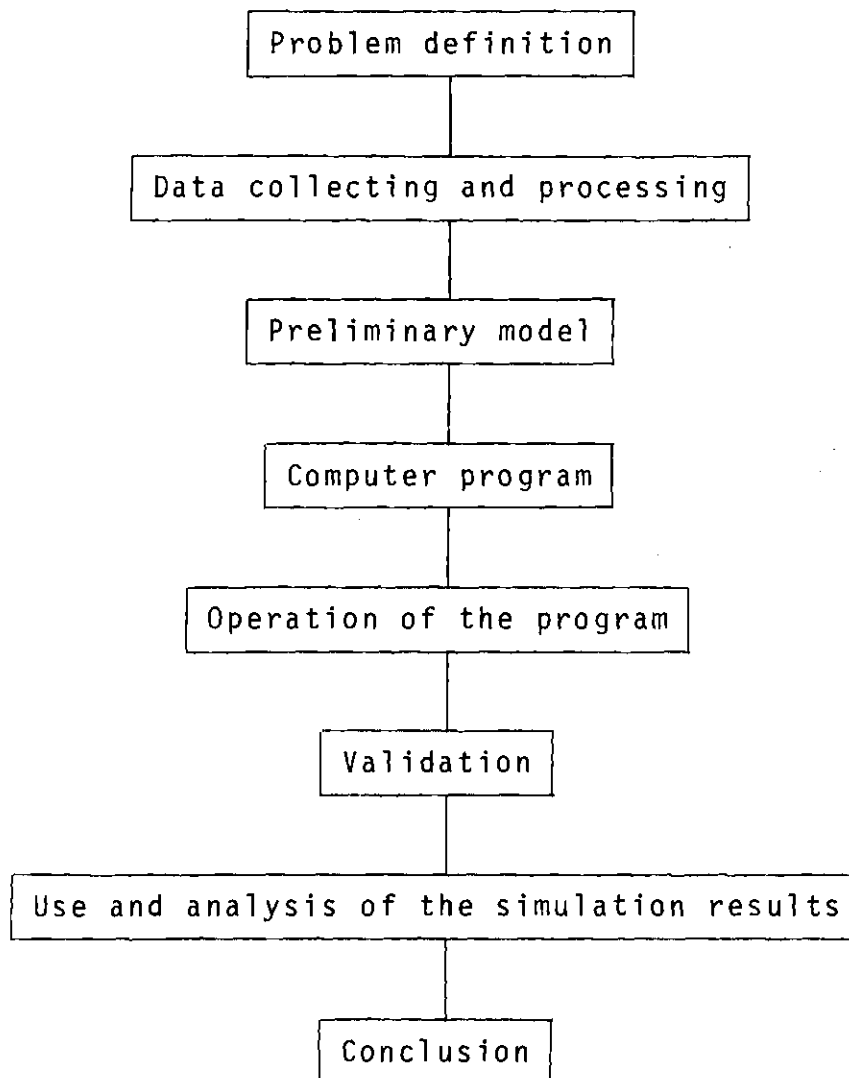
The current effort combines and extends the concepts introduced by Basset and Hettenhouse. It presents the simulation of alternative funding methods and reduces costs to present value. The simulation were performed executive-by-executive, and after tax cash flows were generated for each year of simulated time. All cash flows were reduced to present value. Repeated simulation runs under each set of conditions generated a distribution of cash flows and present values for each case.

CHAPTER II

DETAILED DESCRIPTION OF THE PROBLEM

Simulation Process

A simulation process basically consists of the following steps or activities.



2.1 Executives

The company to be analyzed has an executive group consisting of 31 males.

Data describing each member of the group are presented in Table 1.

2.2 Benefits Provided by the Firm

The firm will provide retirement and death benefits based upon the following formula:

Annual earnings	Percentage of pay	Number of years
\$65,000 & over	65%	15
45,000 but less than 65,000	55%	12
30,000 but less than 45,000	50%	10

Disability can be insured to a maximum of \$3,500 per month based upon the above formula, and it will be payable to recovery or age 65, whichever occurs first. If death or retirement occurs during disability, the death or retirement benefits are payable as determined by the formula.

The simulation process consisted of a year-by-year determination of the cash flows associated with all members of the executive group. Each executive was analyzed and the cash flow: that he represented to the company that year was calculated.

Cash flow depended on the condition of each executive.

Table 1. Rough Data Obtained from the Insurance Company.

Name	Sex	Date of Birth			Date Employed			Basic Earnings
		Mo.	Day.	Year	Mo.	Day.	Year	
1	M	4	27	28			70	\$105,000
2	M	7	27	37			70	100,000
3	M	7	7	21			70	75,000
4	M	12	28	32			70	65,000
5	M	1	17	31	2	13	71	32,500
6	M	5	23	36	12	8	72	36,000
7	M	12	27	34	1	25	71	32,000
8	M	9	26	20	6	26	72	31,500
9	M	2	17	32	10	14	74	32,400
10	M	2	20	34	5	27	71	33,925
11	M	3	17	35	7	1	72	42,000
12	M	9	13	41	7	6	71	45,000
13	M	7	26	40	6	3	74	34,000
14	M	12	6	27	11	10	71	40,000
15	M	5	2	33	4	21	71	40,000
16	M	3	10	38	10	30	72	38,000
17	M	2	23	37	9	7	70	47,000
18	M	6	23	30	9	7	70	36,500
19	M	1	4	38	12	16	74	40,000
20	M	3	8	39	12	22	72	38,000
21	M	3	31	43	6	5	72	36,000
22	M	4	30	29	3	1	71	36,000
23	M	11	3	42	12	6	71	45,000

Table 1. (Concluded).

Name	Sex	Date of Birth			Date Employed			Basic Earnings Annually
		Mo.	Day	Year	Mo.	Day	Year	
24	M	3	17	21	4	5	73	\$ 44,000
25	M	9	6	31	2	1	72	37,500
26	M	12	31	42	10	21	70	55,000
27	M	7	18	36	4	26	71	57,500
28	M	8	23	42	9	21	70	40,000
29	M	10	1	37	10	2	72	33,000
30	M	2	14	30	7	14	71	35,000
31	M	7	24	26	1	25	75	35,000

The definition of the conditions that were possible are listed as follows:

1. Death: (self explanatory). Only deaths that occur prior to retirement are of significance in the simulation.
2. Disability: condition under which the employee cannot perform his job. Two kinds of disability are considered:
 - a. Partial disability refers to the continuous inability of the insured to engage in duties of his occupation for a given time.
 - b. Total disability means only such complete incapacity of the insured that he will never again be able to perform the duties of his occupation.The differentiation between these two types of disability will be done based on the recovery time, considering a person totally disabled if he requires more than four years to recover.
3. Retirement: when a person reaches age 65 he will be retired.
4. Normal condition: a person who has not died or retired and is not currently disabled is considered to be in a completely normal working state.

2.3 Alternate Funding Method

The problem consists of the analysis of different methods to generate funds required to pay the benefits offered by the firm.

Basically there are two options to be analyzed:

1. The firm purchases insurance for each executive with the firm as owner and beneficiary. It can be considered that policy's proceeds are going to be used to pay the benefits.

2. The firm does not purchase any insurance at all and the benefits are going to be paid from company cash reserves.

Option number one can be broken down into four alternative insurance plans:

1. Purchase of a term life insurance policy with disability coverage insuring the entire risk on each executive.

2. Purchase of a permanent life insurance policy with disability coverage to cover all the risk involved with each executive.

3. Purchase of a term life insurance policy with disability coverage insuring half of the risk.

4. Purchase of a permanent life insurance policy covering half of each executive's risk.

2.4 Basic Assumptions

The development of the problem requires some additional assumptions to establish the scope and limitations of the model.

1. Effective date to begin the study 11/1/75.

2. Types of benefits to cover: disability.
retirement.
death.
3. There is no consideration of employee resignation.
4. No entry of new people.
5. No inflation.
6. The age considered for each employee at the start of the simulation is based on the birthday which occurs closest to 11/1/75.
7. No increases in salary.
8. The face amount of the policy used to insure each employee is obtained using the formula given earlier to determine the retirement and disability income. The face will be:
$$\text{FACE} = \text{SALARY} * \text{PERCENTAGE} * \text{YEARS OF COMP. OF PAY}$$
9. All premiums will be waived during disability following an elimination period. Disability premiums are waived after six months and the life insurance premiums after nine months; that is, if the person becomes disabled for a year or more the firm is going to pay a 50% of his disability income premium and a 75% of the life premium the first year. Thereafter until recovery the cash outflow will be zero.
10. The disability is going to be considered total if it requires more than four years to recover.
11. The required tables for premiums calculations were provided by Balser, McCamish & Company.

- a) PR0 rates from ages 32 to 55 for the study of permanent policies.
- b) Term rates to be used are ART-100
- c) "330" disability income are given for ages 32 to 55.

12. The corporate income tax rate is 48% (Federal and State combined).

13. Insurance premiums are not tax deductible expenses for the firm, so they appear in the cash outflow as a full cost.

14. Death benefits are not taxable income, the cash inflow that they represent is the full amount of the policy.

15. The death-retirement benefits paid by the firm are tax deductible, then the cost that they represent is just a 52% of the amount to compensate.

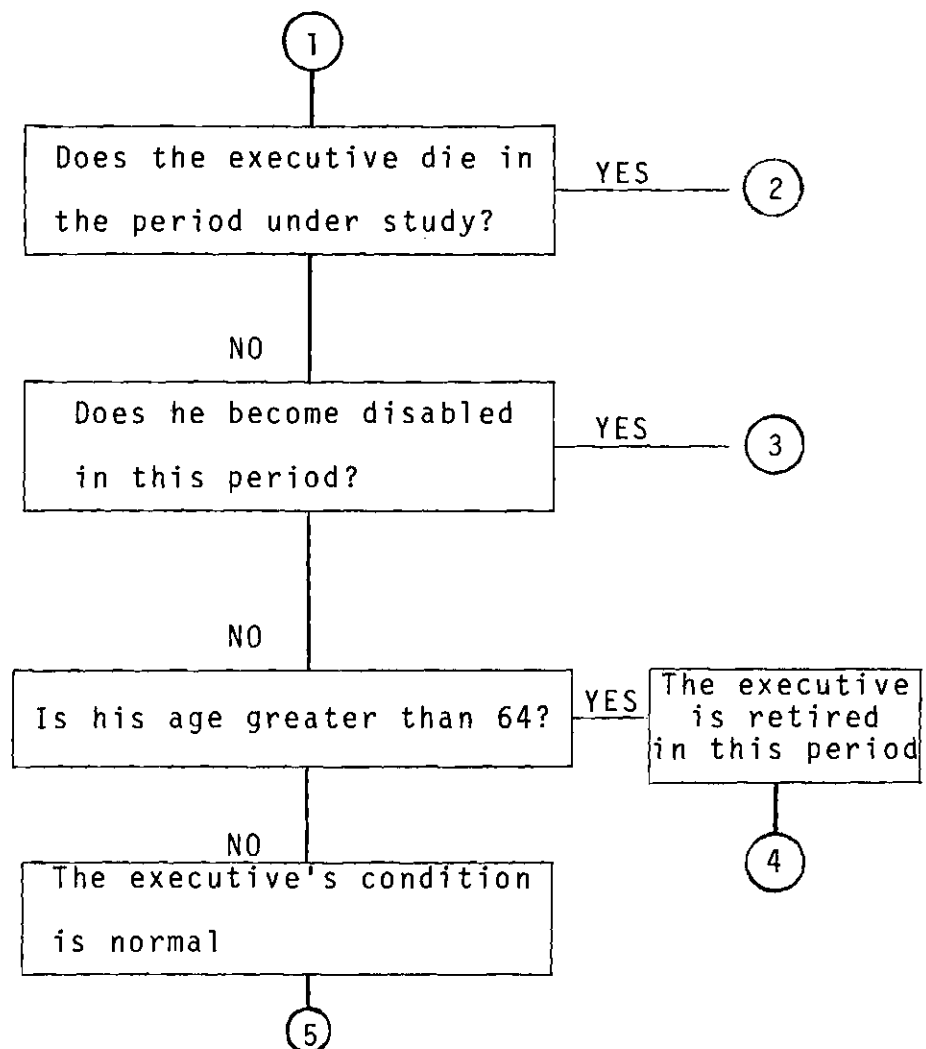
16. Permanent life insurance policies will be "cashed in" at age 65. The cash values are tax free.

17. Deaths are uniformly distributed throughout the year.

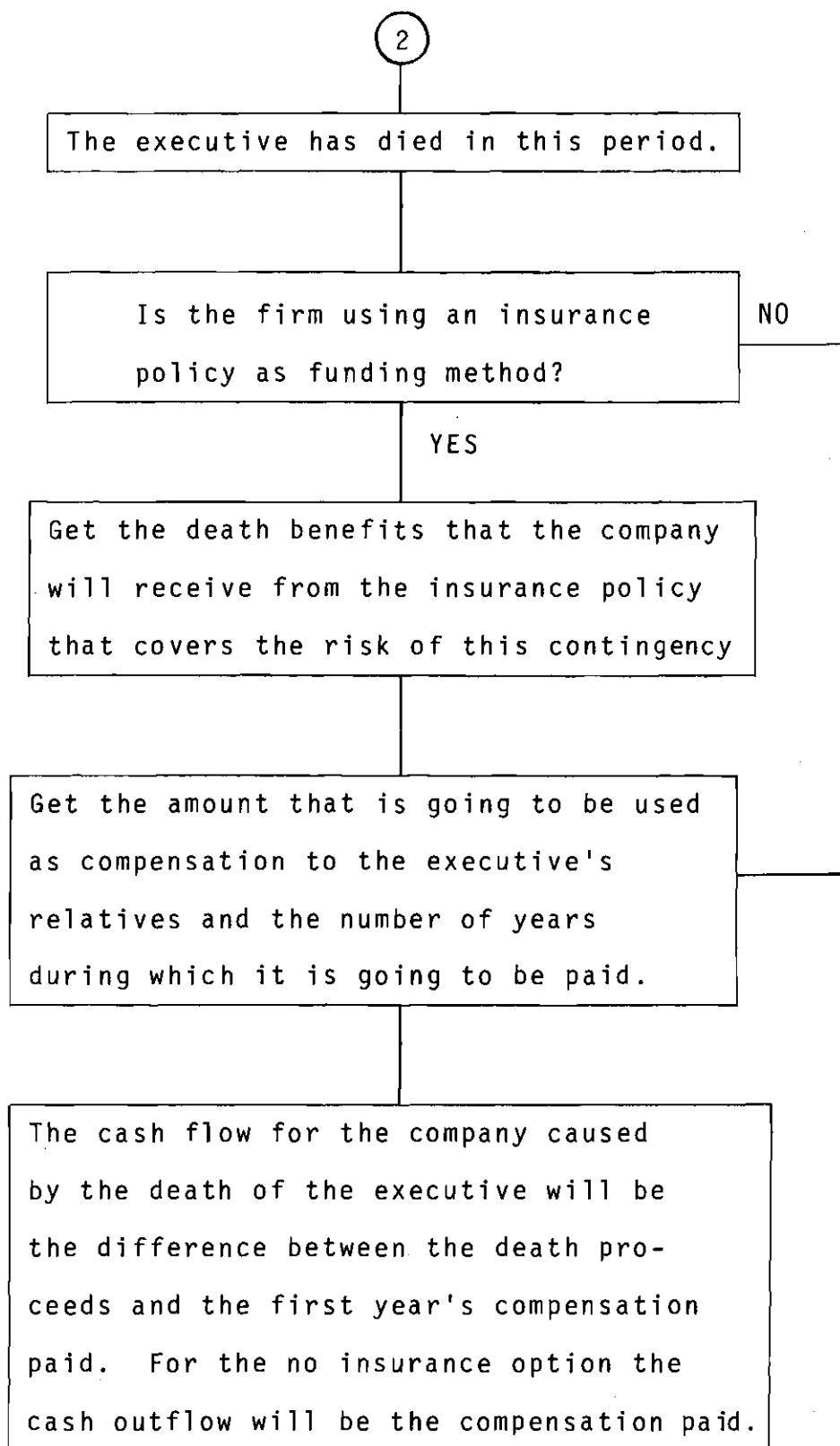
CHAPTER III

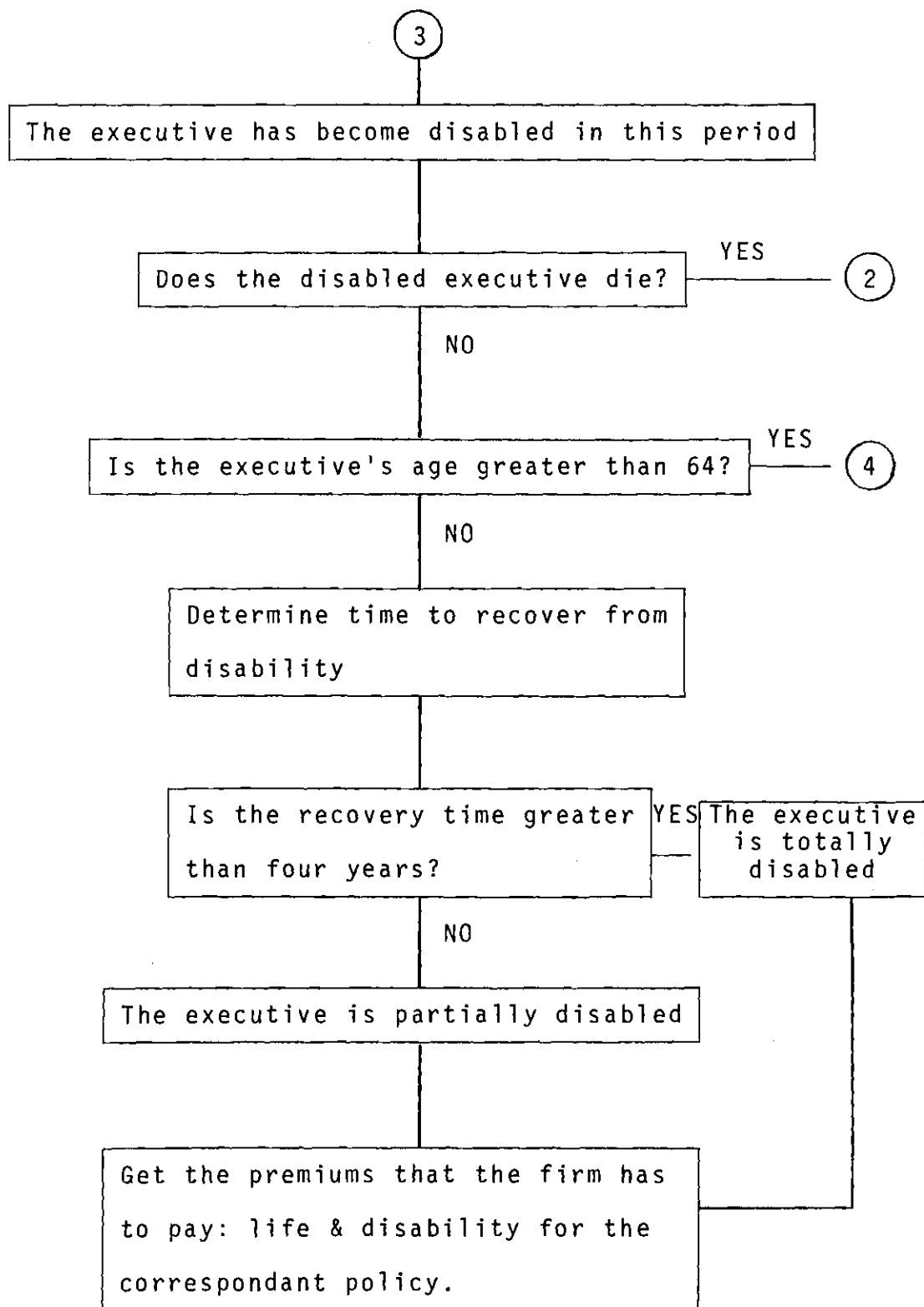
DEVELOPMENT OF THE MODEL

Analyzing the problem it can be seen that the following sequence of questions must be answered for each executive.



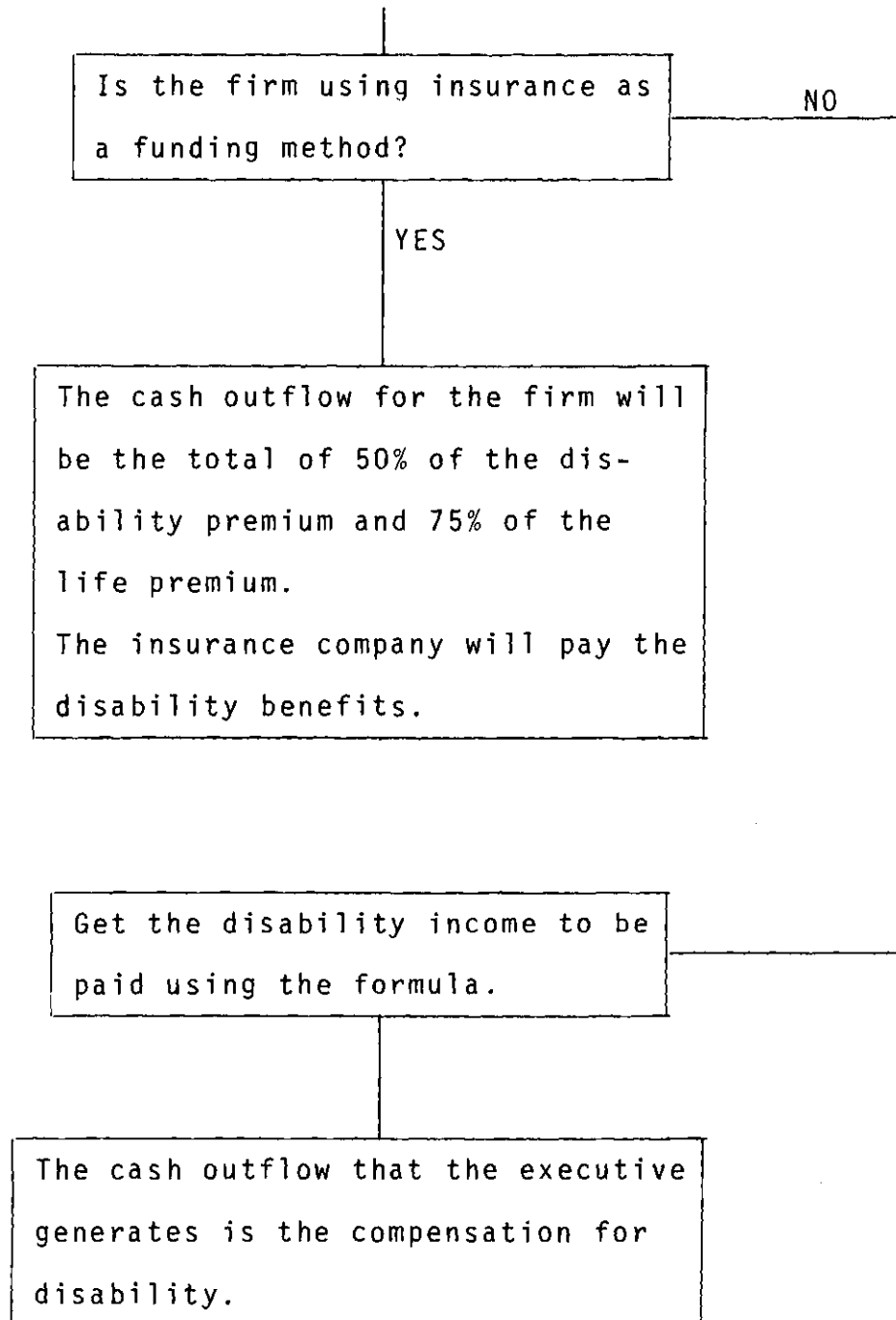
For any condition the possible cash flows will be explained with a flow chart.

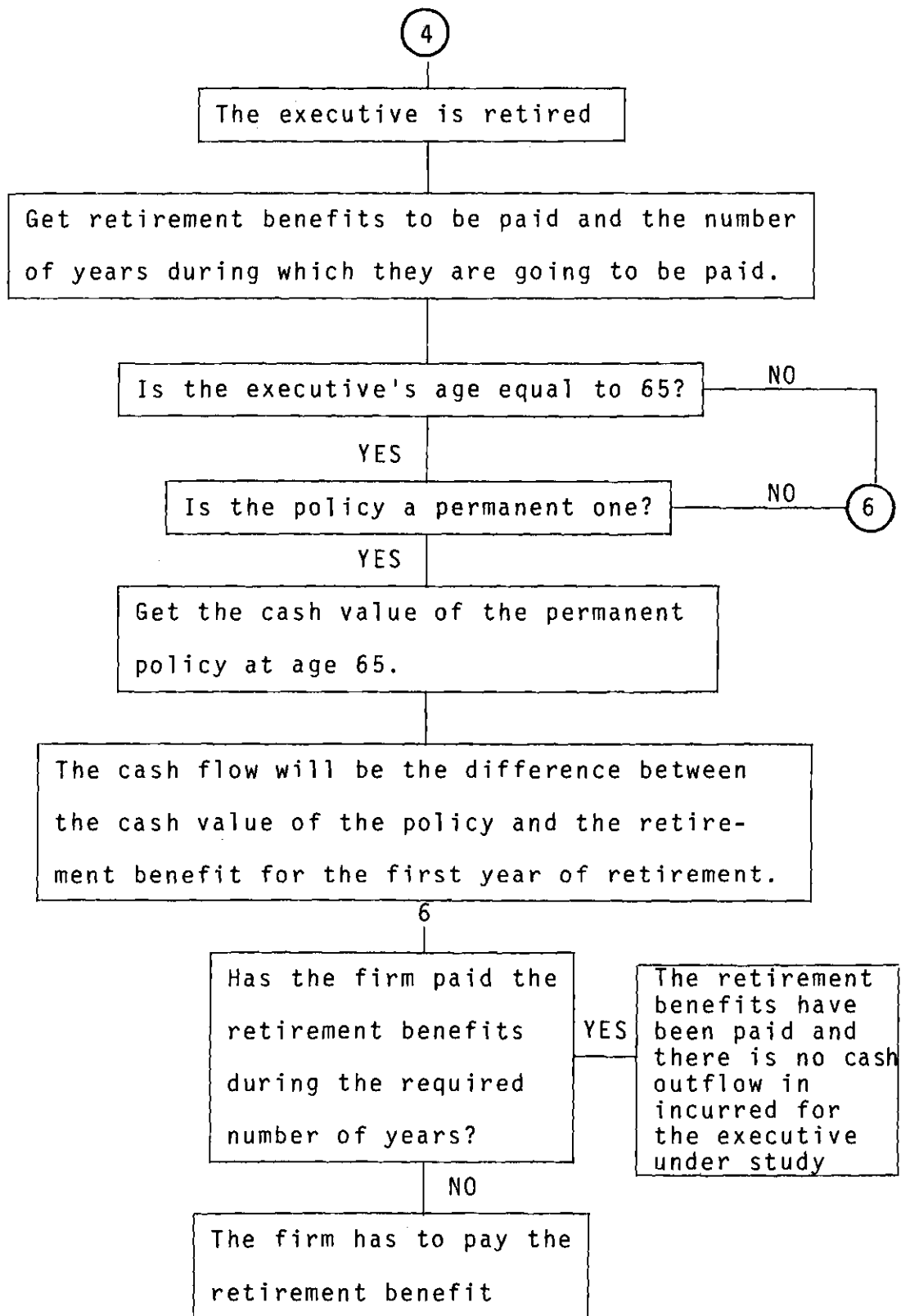


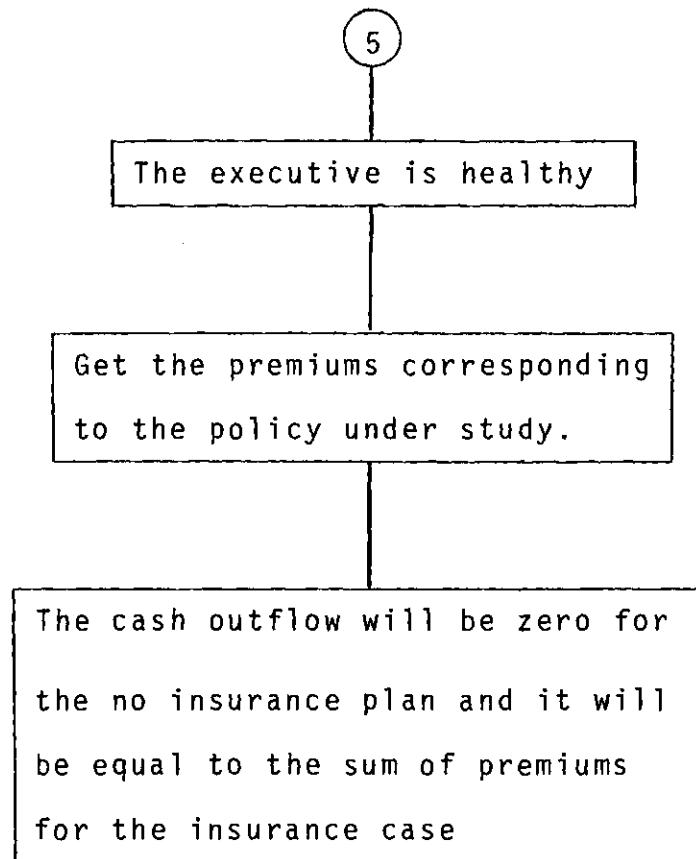


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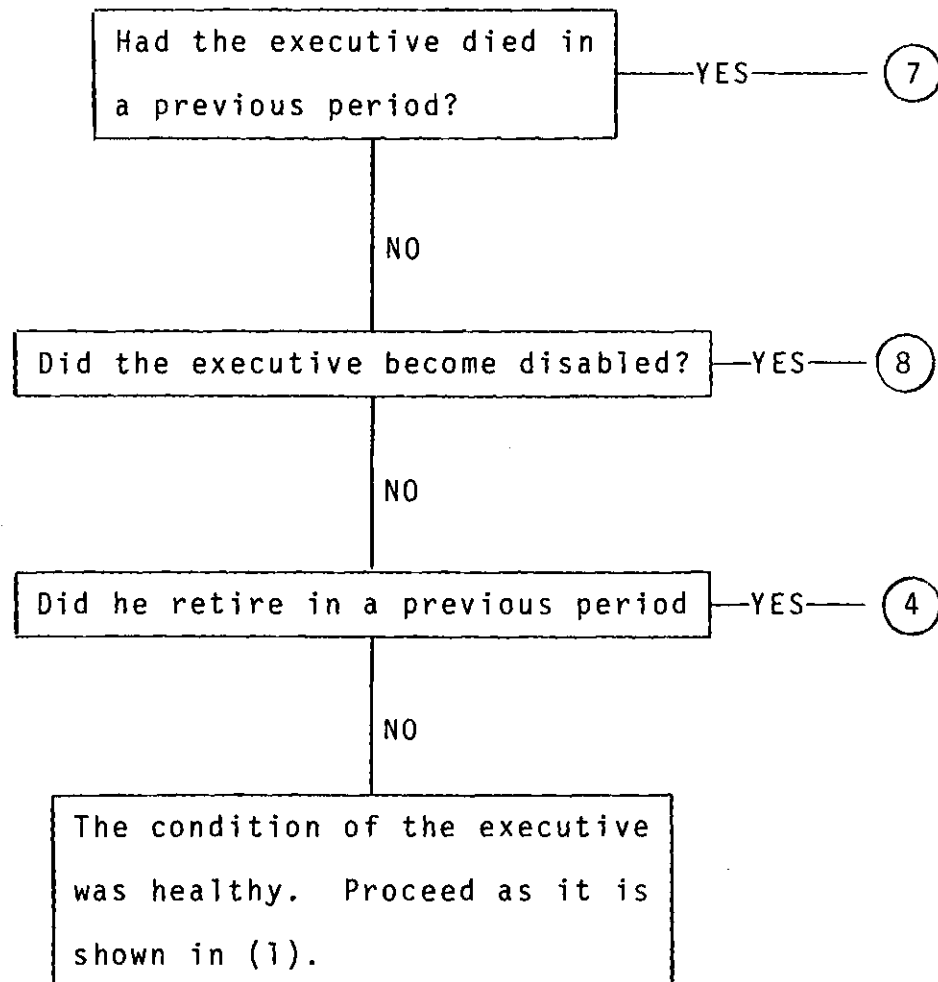
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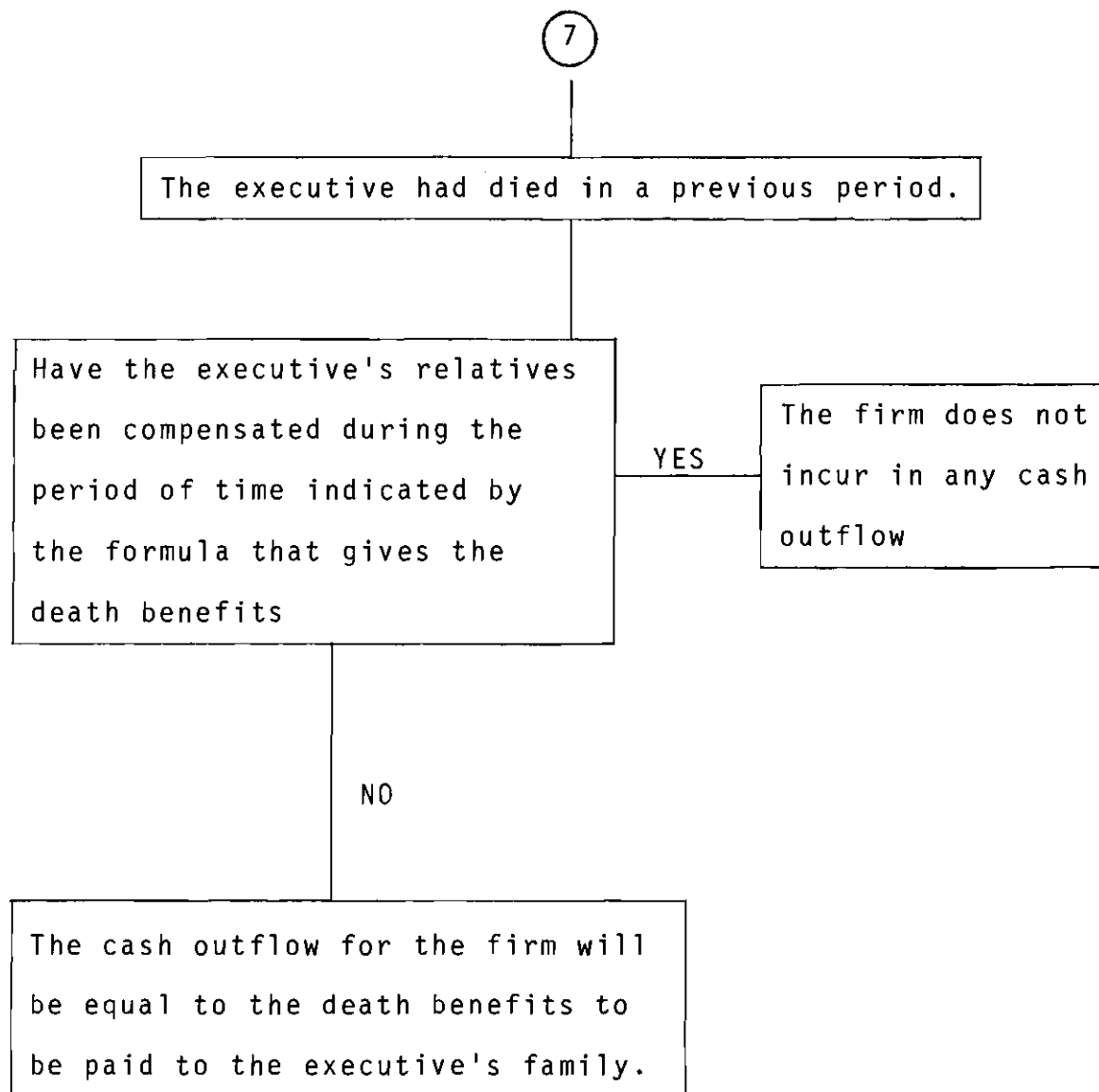


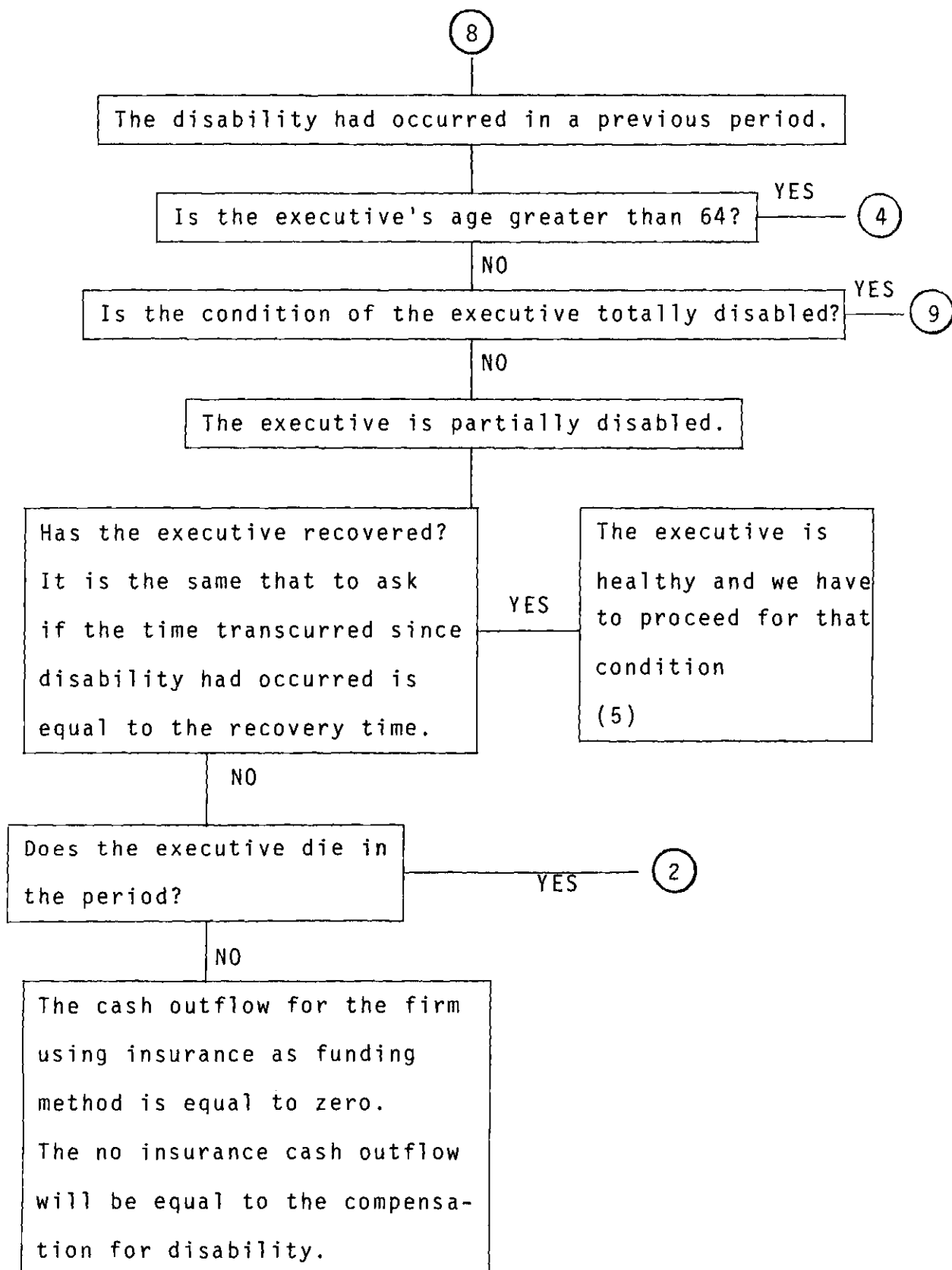




After every member of the executive group has been studied for the first period, the total cash flow for the period is obtained. To obtain the cash flow for the next period the following sequence of questions must be answered.







CHAPTER IV

MODEL IMPLEMENTATION

4.1 Data

The necessary data was provided by Balser, McCamish and Company.

The initial data for each executive are shown in Table 2. These values were obtained from Table 1 using the basic assumptions of Section 2.4.

4.1.1 Mortality Tables

In determining the premium to be charged for assuming a risk the major consideration is death; so the probability of death is of prime importance in life-insurance rate making. A mortality table gives the rate of mortality that represents the probability that a given person who has attained a given age will die before he attains the next higher age in years. Mortality tables are classified on basis of data affected by medical selection as:

1. Aggregate.
2. Select.
3. Ultimate.

An aggregate mortality table is one based on population statistics prepared by the Census Bureau of the United States Government periodically, showing mortality rates of the

Table 2. Basic Data Processed from Table 1.

Executive	Age	Salary	Face Amount
1	48	\$ 105,000	\$ 1,023,750
2	38	100,000	975,000
3	54	75,000	731,250
4	43	65,000	633,750
5	45	32,500	162,500
6	39	36,000	180,000
7	41	32,000	160,000
8	55	37,500	187,550
9	44	32,400	162,000
10	42	33,925	169,625
11	41	42,000	210,000
12	34	45,000	297,000
13	35	34,000	170,000
14	48	40,000	200,000
15	43	40,000	200,000
16	38	38,000	190,000
17	39	47,000	310,200
18	45	36,500	182,500
19	38	40,000	200,000
20	37	38,000	190,000
21	33	36,000	180,000
22	47	36,000	180,000
23	33	45,000	297,000
24	55	44,000	220,000

Table 2. (Concluded)

Executive	Age	Salary	Face Amount
25	44	\$ 37,500	\$ 187,500
26	33	55,000	366,300
27	39	57,500	379,500
28	33	40,000	200,000
29	38	33,000	165,000
30	46	35,000	175,000
31	49	35,000	175,000

country. These tables are not used in rate-making since life insurance companies select risks rather than insure all applicants. Consequently, mortality experienced by the insurance companies should be less than that stated in general population tables. A Select mortality table shows the rate of mortality among a group of recently selected lives at age of entry and each year thereafter. This is because of the fact that mortality among insured lives depends, not only upon the attained age of the lives, but also on the ages at which they were examined or selected for life insurance. People who have just been accepted are far less likely to die within one year than those of the same age accepted ten years ago. Each Select mortality table has an estimate of the time over which the beneficial effects of selection wear off. Usually it is between 5 and 15 years.

An Ultimate mortality table shows the mortality rate at various ages after the selection period has worn off. The rate is given for policies which have been in force more than 15 years.

For the problem analyzed in this paper, the use of a Select mortality table for the first 15 years was recommended. As duration increases, selection becomes less important and then the use of an Ultimate mortality table was recommended for this study.

Table 3. 1955-1960 Select Basic Tables.
 Graduate Mortality Rates per 1,000.

YEAR	30-34	35-39	40-44	45-49	50-54	55-59
1	.62	.92	1.52	2.15	3.23	4.34
2	.76	1.18	2.04	2.97	4.58	6.34
3	.93	1.50	2.49	3.82	6.13	8.72
4	1.04	1.74	2.96	4.56	7.21	10.50
5	1.13	1.99	3.32	5.22	7.91	11.55
6	1.30	2.27	3.91	5.97	9.48	13.30
7	1.46	2.61	4.36	6.90	11.08	15.56
8	1.72	2.94	4.86	7.66	12.10	17.10
9	2.00	3.34	5.40	8.35	13.08	18.96
10	2.32	3.83	6.10	9.25	14.45	21.16
11	2.63	4.37	6.92	10.44	15.84	23.89
12	2.96	4.94	7.72	11.84	17.70	27.21
13	3.38	5.46	8.74	13.70	20.24	30.66
14	3.95	6.22	9.77	15.70	22.88	34.85
15	4.56	7.26	10.65	17.82	25.08	38.62

Table 4. Ultimate Basic Tables.

Graduate Mortality Rates per 1,000.

AGE	MALE LIVES	AGE	MALE LIVES
40	2.12	65	27.99
41	2.36	66	30.34
42	2.66	67	33.04
43	3.02	68	35.92
44	3.45	69	39.27
45	3.96	70	42.90
46	4.51	71	46.45
47	5.09	72	49.96
48	5.71	73	53.72
49	6.34	74	58.16
50	6.94	75	63.36
51	7.56	76	69.04
52	8.32	77	75.09
53	9.20	78	81.98
54	10.09	79	89.68
55	11.00	80	97.68
56	12.06	81	105.42
57	13.26	82	113.40
58	14.60	83	122.90
59	16.06	84	135.00
60	17.69	85	149.17
61	19.55	86	165.94
62	21.61	87	182.12
63	23.75	88	196.71
64	25.83	89	213.26

The Select mortality table furnishes a lower mortality rate in the first 15 years. This approach tends to make the use of life insurance less attractive for the firm, and therefore may be considered a more conservative approach from the standpoint of the insurance agent.

4.1.2 Disability Tables

The table chosen is based on a group which insures less than 5,000 lives, and the table gives for five year intervals the amount of people that can become disabled on the sample. The probability of becoming disable is the same for any age in the interval.

Table 5. Disability Table. Group Disability Insurance
Crude Rates of Disablement per 1,000 lives.
Six Months Elimination Period.

Age	Rate
Under 40	0.77
40-44	1.92
45-49	3.02
50-54	5.64
55-59	10.33
60-64	14.92

The procedure of sequentially sampling for death and disability in each simulated year causes the effective probability of disability to be $(1 - P_{\text{death}}) \cdot P_{\text{disability}}$, where the values of P_{death} and $P_{\text{disability}}$ are those contained in the tables. This results in a slightly underestimated occurrence of disability.

4.1.3 Recovery Time Table

The recommended table gives the number of cases that can recover for a given age in a period of time.

Table 6. Recovery Time Table. Group Long Term Disability Insurance.
Crude Termination Rates per 1,000 Claims Exposed to Death or Recovery.
Six Months Elimination Period.
Calendar Year 1962-1971

Year	30-39	40-49	50-59	60-64
1	314.2	214.8	132.8	100.3
2	298.6	214.1	150.5	119.6
3	233.1	161.7	109.6	105.6
4	75.9	117.0	89.2	64.0
>4	78.2	292.1	514.9	610.5

4.1.4 Term Policy

The term policy to be used will be an annual renewable, premiums increase annually based on attained age and they were taken from the ART - 100 table per \$1,000 of the policy's face amount.

There are two different tables to get the premiums depending on the amount of the policy:

- a) Table 7 for policies from \$25,000 - 99,999
- b) Table 8 for policies of \$100,000 or more

The premiums for a given age will be obtained considering:

- a) The attained age
- b) The number of years since the policy was issued (1,2,3.....) because the factors are different

for the first three years as it is shown in
Tables 7 and 8.

$$\text{Premium} = \frac{\text{Factor}}{1,000} * \text{face amount} + 10.$$

Death benefits of the policy will change each year
with the addition of dividends at the end of the year.

$$\text{Death proceeds} = \frac{1 + \text{dividends}}{1,000} * \text{death proceeds}$$

actual year previous year

The different values for each policy were obtained
using a computer program (TERMFA) showed in Appendix E.
Illustrative example:

Executive 3 Age = 54 Salary \$75,000
Face amount = \$731,250

For the first year

From Table 8 Age 54 Factor = \$13.13/1000

$$\begin{aligned} \text{Premium for the 1st year} &= \frac{13.13}{1,000} * 731.250 + 10. \\ &= \$9,611 \end{aligned}$$

4.1.5 Permanent Policy

"Ledger statements" from age 32 through age 55 for
a \$1,000,000 face amount policy will provide the necessary
data to calculate the premiums, death benefits, and cash
values for the permanent policies.

Table 7. ART-100. Term Insurance Factors for Policies with
Face Amount between \$ 25,000-99,999.

AGE	FACTOR $1 \leq n \leq 3$	FACTOR $n > 3$	DIVIDENDS
32	\$ 3.45	\$ 3.70	\$.25
33	3.55	3.80	.27
34	3.65	3.91	.28
35	3.78	4.05	.29
36	3.94	4.22	.32
37	4.13	4.43	.34
38	4.36	4.67	.36
39	4.63	4.97	.38
40	4.94	5.30	.41
41	5.27	5.65	.43
42	5.63	6.05	.46
43	6.01	6.47	.48
44	6.42	6.91	.50
45	6.86	7.39	.52
46	7.39	7.97	.57
47	7.95	8.58	.61
48	8.58	9.27	.65
49	9.30	10.05	.73
50	10.10	10.92	.82
51	10.95	11.84	.91
52	11.90	12.87	1.03
53	13.03	14.09	1.26
54	14.31	15.47	1.56
55	15.77	17.03	1.96
56	17.41	18.79	2.49
57	19.21	20.72	2.92

Table 7. (Concluded).

AGE	FACTOR $1 \leq n \leq 3$	FACTOR $n > 3$	DIVIDENDS
58	\$ 21.28	\$ 22.93	\$ 3.58
59	23.54	25.35	4.29
60	22.95	24.93	2.00
61	24.79	26.95	2.00
62	26.80	28.16	2.00
63	29.00	31.58	2.00
64	31.39	34.21	2.00
65	32.03	35.11	2.00

Table 8. ART-100. Term Insurance Factors for Policies with
Face Amount of \$ 100,000 or more.

AGE	FACTOR $1 \leq n \leq 3$	FACTOR $n > 3$	DIVIDENDS
32	\$ 2.71	\$ 2.96	\$.25
33	2.79	3.04	.27
34	2.87	3.13	.28
35	2.98	3.25	.29
36	3.12	3.40	.32
37	3.29	3.59	.34
38	3.50	3.81	.36
39	3.75	4.09	.38
40	4.04	4.40	.41
41	4.35	4.74	.43
42	4.69	5.11	.46
43	5.05	5.51	.48
44	5.44	5.93	.50
45	5.86	6.39	.52
46	6.37	6.95	.57
47	6.91	7.54	.61
48	7.52	8.21	.65
49	8.22	8.97	.73
50	9.00	9.82	.82
51	9.83	10.72	.91
52	10.76	11.73	1.03
53	11.87	12.93	1.26
54	13.13	14.29	1.56
55	14.57	15.83	1.95
56	16.21	17.59	2.41
57	18.01	19.52	2.92

Table 8. (Concluded).

AGE	FACTOR $1 \leq n \leq 3$	FACTOR $n > 3$	DIVIDENDS
58	\$ 20.08	\$ 21.73	\$ 3.58
59	22.34	24.15	4.28
60	21.75	23.73	2.00
61	23.59	25.75	2.00
62	25.60	27.96	2.00
63	27.80	30.38	2.00
64	30.19	33.01	2.00
65	30.83	33.91	2.00

To determine the annual rate per \$1,000 for a given executive take the annual premium for a \$1,000,000 face amount policy, subtract \$10 and divide by 1,000. The annual premium will be the rate found times the policy's face value plus \$10.

Illustrative example:

$$\begin{aligned}
 &\text{Executive 3} \quad \text{Age} = 54 \quad \text{Face} = \$731,250 \\
 &\text{From ledger statement} \quad \text{Annual premium} = \$46,910 \\
 &\text{Annual rate} = \frac{46,910 - 10}{1,000} = \$46.90/\text{year} \\
 &\text{Annual Premium} = \frac{46.90}{1,000} * 731,250 + 10 \\
 &= \$34,305/\text{year}
 \end{aligned}$$

The cash value and death proceeds for each year can be calculated as the value from the ledger statement for a \$1,000,000 policy multiplied by the policy's face amount and divided by 1,000,000.

Illustrative example:

After one year:

Cash value = \$18,000

Death benefits = \$1,000,000

Cash value executive 3 = $18,000 * \frac{731,250}{1,000,000} = 13,162.50$
after one year

Death benefits = $1,000,000 * \frac{731,250}{1,000,000} = \$731,250$
after one year

Table 9. PRO Factors for Permanent Policies.

AGE	FACTOR/1000
32	20.30
33	20.96
34	21.65
35	22.38
36	23.15
37	23.98
38	24.82
39	25.72
40	26.66
41	27.65
42	28.70
43	29.80
44	30.96
45	32.19
46	33.48
47	34.85
48	36.30
49	37.82
50	39.44
51	41.15
52	42.95
53	44.87
54	46.90
55	49.06

Table 10. Cash Value of \$1,000,000 Face Amount
Policy at Age 65.

EXECUTIVE	AGE	CASH VALUE
1	48	\$ 647,667
2	38	934,876
3	54	445,120
4	43	813,280
5	45	756,549
6	39	899,487
7	41	832,024
8	55	411,551
9	44	736,097
10	42	846,135
11	41	832,024
12	34	1,082,293
13	35	1,043,091
14	48	647,667
15	43	813,280
16	38	934,876
17	39	899,487
18	45	756,549
19	38	934,876
20	37	970,849
21	33	1,120,229
22	47	684,157
23	33	1,120,229
24	55	411,551
25	44	736,097
26	33	1,120,229
27	39	899,487
28	33	1,120,229

Table 10. (Concluded).

EXECUTIVE	AGE	CASH VALUE
29	38	\$ 934,876
30	46	721,164
31	49	611,903

4.1.6 Disability Benefits

The life insurance contract is going to be taken with disability benefits:

- a) waiver of premium
- b) disability income.

A waiver of premium provides that in the event of disability, premiums on the contract will be waived during the continuance of disability beyond a specified period (elimination period) and the policy's operation continues as if premiums were paid: dividends are continued, cash value increases (in the case of a permanent policy and so forth) (8).

The disability premium is obtained as a function of the salary and the age at which the policy was signed. The annual rate is given by \$100 of annual benefits and it considers an elimination period of 180 days (6 months).

The calculations of disability premiums will be done as follows:

- 1) take the executive's salary and find the annual disability income to be paid, using statements of section 2.2

$$\text{Disability income} = \text{salary} * \text{percentage}$$

- 2) If the monthly disability income:

$$\frac{\text{Salary} * \text{Percentage}}{12} > 3,500$$

12

then the disability income will be \$3,500/month

Table 11. "330" Disability Income Annual Rates
for Premium Calculation.
180 Days Elimination Period. Male.

AGE	ANNUAL RATE/100
<hr/>	
32	\$ 29.49
33	30.65
34	31.87
35	33.16
36	34.52
37	35.94
38	37.43
39	39.00
40	40.68
41	42.41
42	44.23
43	46.15
44	48.10
45	50.16
46	53.38
47	55.43
48	57.50
49	59.61
50	61.70
51	63.81
52	65.86
53	67.85
54	69.62
55	70.99

- 3) For the attained age when the policy was signed
get the annual rate per \$100 monthly benefit
(Table 11)
- 4) The disability premium will be:

$$\text{Annual Premium} = \left[\left(\frac{\text{monthly disability income}}{\text{percentage}} \right) * \frac{\text{rate} + 10}{100} \right] * (0.075) * 12$$

Illustrative example:

Executive 3 Age 54 Salary \$75,000

From assumption 7, percentage = 65%

$$\begin{aligned} \text{Disability income} &= 75,000 * .65 \\ &= \$48,750 \end{aligned}$$

$$\text{Monthly disability income} = \frac{48,750}{12} > 3,500$$

Then we have to set disability income = 3,500 \$/month

For age = 54 Table 11 gives Rate = 69.62

$$\text{Annual disability premium} = \left[\left(\frac{3,500 * 69.62}{100} \right) + 10 \right] * (0.075) * (12)$$

$$\text{Annual disability premium} = \$2,191.4$$

4.1.7 Death - Retirement Benefits

The amount to be paid as death-retirement benefits is based on the individual's salary and is given by the formula:

Annual earnings	Percentage to pay	Number of years
65,000 and over	65	15
45,000 but less than 65,000	55	12
30,000 but less than 45,000	50	10

As an example to see as it works, for the executive 3.

Salary = 75,000

Percentage = 65%

Compensation = \$48,750 for a period of 15 years

But the real cost for the company will be:

$(.52) (48,750) = \$25,350$

Because this is a tax deductible expense and the total income tax rate for the corporation is 48 percent.

4.2 Program Operation

The simulations were stochastically generated using a random number generator (RANF) CDC supplied, that gave numbers uniformly distributed between zero and one. These numbers, when compared to the probabilities of various events, such as death, disability, and recovery time, determined the sequence of events for each executive.

The random number generator was operated with a different initialization (SEED) each time that the program was run. Thus, each simulation presented a different behavior reflected in the different results obtained (see Figures 11 through 15).

4.3 Validation

The validation of the model is presented in different figures, the reference in each one are based upon the funding method that was used to generate the cash required to pay the benefits. Those references are:

- Case 1 referring to the use of a term policy insuring 100% of the risk.
- Case 2 same as Case 1 but using a permanent policy.
- Case 3 the funding method used is a term policy insuring half of the risk.
- Case 4 same as Case 3 but with a permanent policy.
- Case 5 the firm does not use any funding method; that is, it does not purchase any insurance policy.

Figures 5 through 9 represent the condition (status) and cash flow after taxes that the executive 23 generates each year in the firm during the simulation period. Before checking the detailed calculations for each case, it is worthwhile to look at the overall patterns of cash flows versus the status of the executive.

In Figure 5, the cash outflows were growing during the first eleven years as would be expected since the policy was a term one. In the 11th year the executive becomes disabled, generating a cash flow just that year and none the years that he stayed disabled.

For the Figure 6, the characteristics of a permanent

policy can be seen: the cash flows are constant until the moment in which the executive reaches age 65, then the cash flow is the result of cashing in the policy and payment of the first retirement benefit.

In the Figure 7, the firm does not represent any cash inflow because the executive did not die and the funding method considers a term policy.

Figure 8, half permanent policy, the executive dies at age 63 and the death proceeds minus the first death benefit represent the cash flow for that period.

The no insurance case, Figure 9, shows just cash outflows to pay retirement benefits during the number of years that the formula indicated for his salary level: 12 years.

4.3.1 Step by Step Calculations to Validate the Program's Operation

The data for the executive 23 is:

Age = 33 years
 Salary = \$45,000/year
 Face amount = \$297,000

The disability income premium is constant and it has the same value for any policy.

Age = 33 Annual rate/100 = 30.65 (Table 11)

Salary = \$45,000 percentage to be considered = 55%

Monthly disability income = $45,000 * 0.55 = \$2,062.50/\text{month}$

AGE	STATUS	CASE 1	CASH FLOW
33	3	Normal	-1416.57
34	3	"	-1440.33
35	3	"	-1473.00
36	3	"	-1597.74
37	3	"	-1654.17
38	3	"	-1719.51
39	3	"	-1802.67
40	3	"	-1894.74
41	3	"	-1995.72
42	3	"	-2105.61
43	2	Disabled	-1523.82
44	2	"	0.00
45	2	"	0.00
46	2	"	0.00
47	3	Normal	-2827.32
48	3	"	-3026.31
49	3	"	-3252.03
50	3	"	-3504.48
51	3	"	-3771.78
52	3	"	-4071.75
53	3	"	-4428.15
54	3	"	-4832.07
55	3	"	-5289.45
56	3	"	-5812.17
57	3	"	-6385.38
58	3	"	-7041.75
59	0	Death	292655.24
60	0	"	-12870.00
61	0	"	-12870.00
62	0	"	-12870.00
63	0	"	-12870.00
64	0	"	-12870.00
65	0	"	-12870.00
66	0	"	-12870.00
67	0	"	-12870.00
68	0	"	-12870.00
69	0	"	-12870.00
70	0	"	-12870.00
71	0	"	-0.00
72	0	"	-0.00
73	0	"	-0.00
74	0	"	-0.00
75	0	"	-0.00
76	0	"	-0.00
77	0	"	-0.00
78	0	"	-0.00

Figure 5. Validation Executive 23.Full Term Policy.

AGE	STATUS	CASE 2	CASH FLOW
33	3	Normal	-6813.06
34	3	"	-6813.06
35	2	Disabled	-4965.31
36	2	"	0.00
37	2	"	0.00
38	3	Normal	-6813.06
39	3	"	-6813.06
40	3	"	-6813.06
41	3	"	-6813.06
42	3	"	-6813.06
43	3	"	-6813.06
44	3	"	-6813.06
45	3	"	-6813.06
46	3	"	-6813.06
47	3	"	-6813.06
48	3	"	-6813.06
49	3	"	-6813.06
50	3	"	-6813.06
51	3	"	-6813.06
52	3	"	-6813.06
53	3	"	-6813.06
54	3	"	-6813.06
55	3	"	-6813.06
56	3	"	-6813.06
57	3	"	-6813.06
58	3	"	-6813.06
59	3	"	-6813.06
60	3	"	-6813.06
61	3	"	-6813.06
62	3	"	-6813.06
63	3	"	-6813.06
64	3	"	-6813.06
65	4	Retired	319838.01
66	4	"	-12870.00
67	4	"	-12870.00
68	4	"	-12870.00
69	4	"	-12870.00
70	4	"	-12870.00
71	4	"	-12870.00
72	4	"	-12870.00
73	4	"	-12870.00
74	4	"	-12870.00
75	4	"	-12870.00
76	4	"	-12870.00
77	4	"	-0.00
78	4	"	-0.00

Figure 6. Validation Executive 23. Full Permanent.

AGE	STATUS	CASE 3	CASH FLOW
33	3	Normal	-1002.26
34	3	"	-1014.14
35	3	"	-1030.47
36	3	"	-1092.84
37	3	"	-1121.06
38	3	"	-1153.73
39	3	"	-1195.31
40	3	"	-1241.34
41	3	"	-1291.93
42	3	"	-1346.78
43	3	"	-1406.19
44	3	"	-1468.55
45	3	"	-1536.86
46	3	"	-1620.02
47	3	"	-1707.63
48	3	"	-1807.13
49	3	"	-1919.99
50	3	"	-2046.21
51	3	"	-2179.86
52	3	"	-2329.85
53	3	"	-2508.05
54	3	"	-2710.01
55	3	"	-2938.70
56	3	"	-3200.06
57	3	"	-3486.66
58	3	"	-3814.85
59	3	"	-4174.22
60	3	"	-4111.85
61	3	"	-4411.82
62	3	"	-4740.00
63	3	"	-5099.37
64	3	"	-5489.93
65	4	Retired	-12870.00
66	4	"	-12870.00
67	4	"	-12870.00
68	4	"	-12870.00
69	4	"	-12870.00
70	4	"	-12870.00
71	4	"	-12870.00
72	4	"	-12870.00
73	4	"	-12870.00
74	4	"	-12870.00
75	4	"	-12870.00
76	4	"	-12870.00
77	4	"	-0.00
78	4	"	-0.00

Figure 7. Validation Executive 23. Half Term Policy.

AGE	STATUS	CASE 4	CASH FLOW
33	3	Normal	-3700.50
34	3	"	-3700.50
35	3	"	-3700.50
36	3	"	-3700.50
37	3	"	-3700.50
38	3	"	-3700.50
39	3	"	-3700.50
40	3	"	-3700.50
41	3	"	-3700.50
42	3	"	-3700.50
43	3	"	-3700.50
44	3	"	-3700.50
45	3	"	-3700.50
46	3	"	-3700.50
47	3	"	-3700.50
48	3	"	-3700.50
49	3	"	-3700.50
50	3	"	-3700.50
51	3	"	-3700.50
52	3	"	-3700.50
53	3	"	-3700.50
54	3	"	-3700.50
55	3	"	-3700.50
56	3	"	-3700.50
57	3	"	-3700.50
58	3	"	-3700.50
59	3	"	-3700.50
60	3	"	-3700.50
61	3	"	-3700.50
62	3	"	-3700.50
63	0	Death	229586.92
64	0	"	-12870.00
65	0	"	-12870.00
66	0	"	-12870.00
67	0	"	-12870.00
68	0	"	-12870.00
69	0	"	-12870.00
70	0	"	-12870.00
71	0	"	-12870.00
72	0	"	-12870.00
73	0	"	-12870.00
74	0	"	-12870.00
75	0	"	-0.00
76	0	"	-0.00
77	0	"	-0.00
78	0	"	-0.00

Figure 8. Validation Executive 23. Half Permanent.

AGE	STATUS	CASE 5	CASH FLOW
33	3	Normal	0.00
34	3	"	0.00
35	3	"	0.00
36	3	"	0.00
37	3	"	0.00
38	3	"	0.00
39	3	"	0.00
40	3	"	0.00
41	3	"	0.00
42	3	"	0.00
43	3	"	0.00
44	3	"	0.00
45	3	"	0.00
46	3	"	0.00
47	3	"	0.00
48	3	"	0.00
49	3	"	0.00
50	3	"	0.00
51	3	"	0.00
52	3	"	0.00
53	3	"	0.00
54	3	"	0.00
55	3	"	0.00
56	3	"	0.00
57	3	"	0.00
58	3	"	0.00
59	3	"	0.00
60	3	"	0.00
61	3	"	0.00
62	3	"	0.00
63	3	"	0.00
64	3		0.00
65	4	Retired	-12870.00
66	4	"	-12870.00
67	4	"	-12870.00
68	4	"	-12870.00
69	4	"	-12870.00
70	4	"	-12870.00
71	4	"	-12870.00
72	4	"	-12870.00
73	4	"	-12870.00
74	4	"	-12870.00
75	4	"	-12870.00
76	4	"	-12870.00
77	4	"	-0.00
78	4		-0.00

Figure 9. Validation Executive 23. No Insurance.

$$\text{Monthly disability premium} = \frac{2062.5 * 30.65 + 10}{100}$$

$$= \$642.16$$

$$\begin{aligned}\text{Annual disability premium} &= (0.075) \times (12) \times (642.16) \\ &= \$577.94\end{aligned}$$

The retirement death benefits to be paid

\$45,000 55% for 12 years

Compensation = \$24,750/year

But the cost for the firm considering 48% corporate taxes
is just 52% of the amount, then:

Cost of compensation = \$12,870/year

VALIDATION CASE 1 Full Term Policy

Age	N	Factor (Table 8 and $n \leq 3$)
33	1	2.79
34	2	2.87

$$\begin{aligned} \text{Annual life premium} &= \frac{297,000}{1,000} * 2.79 + 10 = \$838.63 \\ \text{first year} \end{aligned}$$

$$\begin{aligned} \text{Total annual premium} &= (\text{life} + \text{disability}) \text{ premiums} \\ &= 838.63 + 577.94 \end{aligned}$$

$$\begin{aligned} \text{Total premium} &= \$1,416.57 \\ \text{first year} \end{aligned}$$

$$\begin{aligned} \text{Total premium} &= \frac{297,000}{1,000} * 2.87 + 10 + 577.94 \\ \text{second year} &= \$1,440.33 \end{aligned}$$

For age = 43 the executive becomes disabled; then that year the premium was:

$$\begin{aligned} \text{Total premium} &= 0.75 * \text{life premium} + 0.5 * \text{disability premium} \\ &= 0.75 * \frac{297,000}{1,000} * 5.51 + 10 + 0.5 * 577.94 \\ &= \$1,523.82 \end{aligned}$$

At age 47 the executive has recovered, then the firm has to pay his premiums

Factor = 7.54 (Table 8 for $n > 3$)

$$\begin{aligned} \text{Annual life premium} &= \frac{297,000}{1,000} * 7.54 + 10 \\ &= \$2,249.38 \end{aligned}$$

$$\begin{aligned} \text{Total cash outflow at age 47} &= 2,249.38 + 577.94 \\ &= \$2,827.32 \end{aligned}$$

At age 59 the executive died

Death proceeds = \$305,525.24 (Appendix E)

Death benefits = \$12,870

$$\begin{aligned} \text{Cash flow for the firm} &= 305,525.24 - 12,870 \\ &= \$292,655.24 \end{aligned}$$

For the following 11 years the outflow is the amount paid as compensation.

VALIDATION CASE 2 Full permanent Policy

The premiums paid are constant:

Age = 33 Factor/1000 = 20.97 (Table 9)

Annual life premium = $\frac{20.96}{1,000} * 297,000 + 10 = 6,235.12$

Total annual outflow = life premium + disability premium
 = 6,235.12 + 577.94
 = \$6,813.06

The executive did not die, the policy is "cashed in" by the firm.

Cash value of the policy = $1,120,229 * \frac{297,000}{1,000,000}$ (Table 10)

= \$332,708

Retirement benefit = \$12,870

Total cash flow at = \$319,838.00

age 65

VALIDATION CASE 3 Half term policy

Face = \$148,500

Disability premium = \$577.94

Age	Factor	Life Premium = Factor * $\frac{\text{Face}}{1,000}$ + 10	Disability Premium	Total Cash Flow at Age
33	2.79	424.94	577.94	1002.26
34	2.87	436.20		1014.14
35	2.98	452.53		1030.47
36	3.40	514.90		1092.84

As the executive did not die, at age 65 the firm began to pay his retirement benefit for 12 years.

VALIDATION CASE 4 Half permanent policy

Face = \$148,500

Age = 33 Factor/1000 = 20.96 (Table 9)

Annual life premium = $\frac{20.96}{1,000} * 148,500 + 10 = \$3,122.56$

Total annual premium = $3,122.56 + 577.94$
 at age = \$3,700.5

Age 63, the executive dies.

Death proceeds = $\frac{148,500}{1,000,000} * 1,632,706.5 = \$242,456.92$

Death benefits = \$12,870

Total cash flow at age 63 = $242,456.92 - 12,870$
 = \$229,586.92

VALIDATION CASE 5 No insurance

Executive reaches age 65 and the firm paid his compensation (\$12,870) during 12 years.

CHAPTER V

RESULTS

The program was run twenty times with different initialization (SEED) for the random number generator (RANF), in such a way that different event occurred for the same executive in different simulations. This can be seen comparing Figures 8 and 10. For the executive 23 in Figure 8, death occurs at age 65; meanwhile in Figure 10, the executive becomes disable at age 63 and at age 65, he is retired.

Figures 11 through 15 show the total present values of the cash flows for each of twenty simulations under all five funding methods. The present values are shown as calculated with four different discount rates.

Table 12 presents the means of the total present values for each funding method and discount rate.

Figures 16 through 20 present the patterns of cash flows for these same simulations runs under each of the five funding methods.

AGE	STATUS	CASE 4	CASH FLOW
33	3	Normal	-3700.50
34	3	"	-3700.50
35	3	"	-3700.50
36	3	"	-3700.50
37	3	"	-3700.50
38	3	"	-3700.50
39	3	"	-3700.50
40	3	"	-3700.50
41	3	"	-3700.50
42	3	"	-3700.50
43	3	"	-3700.50
44	3	"	-3700.50
45	3	"	-3700.50
46	3	"	-3700.50
47	3	"	-3700.50
48	3	"	-3700.50
49	3	"	-3700.50
50	3	"	-3700.50
51	3	"	-3700.50
52	3	"	-3700.50
53	3	"	-3700.50
54	3	"	-3700.50
55	3	"	-3700.50
56	3	"	-3700.50
57	3	"	-3700.50
58	3	"	-3700.50
59	3	"	-3700.50
60	3	"	-3700.50
61	3	"	-3700.50
62	3	"	-3700.50
63	2	Disabled	-2630.89
64	2	"	0.00
65	4	Retired	153484.01
66	4	"	-12870.00
67	4	"	-12870.00
68	4	"	-12870.00
69	4	"	-12870.00
70	4	"	-12870.00
71	4	"	-12870.00
72	4	"	-12870.00
73	4	"	-12870.00
74	4	"	-12870.00
75	4	"	-12870.00
76	4	"	-12870.00
77	4	"	-0.00
78	4	"	-0.00

Figure 10. Validation Executive 23.Half Permanent.

RUN	4%	8%	12%	16%
1	\$-1,588,669	\$- 673,204	\$- 282,014	\$- 93,797
2	-2,639,794	-1,236,419	- 660,943	-395,843
3	-2,740,563	-1,343,353	- 738,760	-440,602
4	-2,510,745	-1,205,007	- 672,664	-428,051
5	-3,264,694	-1,683,864	-1,004,994	-670,546
6	-1,789,983	- 870,522	- 523,421	-372,921
7	-2,405,687	-1,276,328	- 800,526	-567,226
8	-2,673,448	-1,386,650	- 838,850	-570,180
9	-2,903,367	-1,515,785	- 931,270	-646,565
10	-2,248,524	-1,200,615	- 770,355	-561,696
11	-2,402,000	-1,214,354	- 724,111	-484,263
12	-2,388,517	-1,175,890	- 688,980	-466,117
13	-2,706,722	-1,512,361	- 974,945	-694,756
14	-3,081,706	-1,619,559	- 997,054	-690,642
15	-3,077,509	-1,649,593	-1,035,420	-726,350
16	-3,605,206	-1,885,684	-1,146,068	-780,329
17	-2,606,770	-1,329,867	- 794,998	-535,083
18	-2,953,190	-1,510,148	- 888,868	-583,072
19	-3,363,849	-1,795,511	-1,109,141	-764,397
20	-2,300,789	-1,042,565	- 554,806	-355,405

Figure 11. Total Present Value for 20 Runs.

Case 1: Full Term Policy.

RUN	4%	8%	12%	16%
1	\$-1,792,883	\$-1,601,130	\$-1,403,014	\$-1,229,219
2	-2,596,112	-2,152,912	-1,793,137	-1,508,605
3	-1,746,393	-1,627,775	-1,463,477	-1,296,249
4	-2,658,896	-2,235,752	-1,870,080	-1,575,275
5	-2,371,943	-1,980,950	-1,662,149	-1,408,052
6	-1,800,164	-1,489,265	-1,209,897	- 979,579
7	-2,004,031	-1,696,858	-1,443,732	-1,237,391
8	-2,227,072	-1,973,828	-1,708,026	-1,471,777
9	-2,272,045	-1,992,054	-1,716,075	-1,476,600
10	-2,259,691	-1,937,695	-1,659,129	-1,426,316
11	-1,377,598	-1,036,062	- 781,735	- 598,039
12	-2,213,460	-1,875,045	-1,602,345	-1,382,505
13	-1,849,889	-1,702,645	-1,507,509	-1,319,386
14	-1,315,880	-1,240,661	-1,085,232	- 925,235
15	-2,301,871	-2,015,516	-1,729,988	-1,484,034
16	-1,489,788	-1,310,633	-1,157,717	-1,029,957
17	-2,565,857	-2,130,045	-1,790,373	-1,521,766
18	-2,176,836	-1,724,779	-1,385,795	-1,131,531
19	-2,443,656	-2,022,708	-1,691,428	-1,432,467
20	-2,440,913	-2,095,987	-1,778,842	-1,514,825

Figure 12. Total Present Value for 20 Runs.

Case 2: Full Permanent Policy.

RUN	4%	8%	12%	16%
1	\$-2,471,478	\$-1,199,834	\$-686,313	\$-448,698
2	-2,172,298	-1,038,142	-573,358	-359,193
3	-2,388,863	-1,282,368	-750,018	-499,421
4	-2,233,503	-1,082,298	-610,820	-389,079
5	-2,227,788	-1,127,088	-682,601	-470,821
6	-2,330,840	-1,129,203	-636,413	-404,376
7	-2,414,108	-1,131,368	-620,990	-389,860
8	-2,259,681	-1,040,054	-565,807	-355,125
9	-2,516,574	-1,219,451	-693,036	-446,348
10	-2,040,170	- 897,097	-426,532	-204,951
11	-2,319,605	-1,177,953	-704,187	-476,665
12	-1,972,366	- 947,212	-542,137	-361,321
13	-2,396,910	-1,172,059	-668,774	-429,886
14	-2,533,524	-1,239,157	-709,066	-460,007
15	-2,519,732	-1,240,898	-721,056	-477,612
16	-2,389,146	- 903,681	-437,274	-219,638
17	-2,054,698	-1,124,838	-629,025	-406,701
18	-2,228,430	-1,056,521	-591,341	-380,465
19	-1,706,075	- 775,580	-414,895	-257,177
20	-2,260,834	-1,115,928	-639,670	-415,267

Figure 13. Total Present Value for 20 Runs.

Case 3: Half Term Policy.

RUN	4%	8%	12%	16%
<hr/>				
1	\$-1,957,902	\$-1,322,104	\$-1,006,319	\$-815,754
2	-1,954,939	-1,327,208	-1,012,760	-820,730
3	-2,155,861	-1,453,341	-1,096,446	-879,223
4	-2,098,446	-1,392,981	-1,038,241	-825,469
5	-2,108,749	-1,403,746	-1,050,736	-840,079
6	-2,095,787	-1,419,235	-1,074,238	-863,984
7	-2,053,496	-1,359,928	-1,017,452	-812,040
8	-1,744,294	-1,119,046	- 795,656	-595,315
9	-2,134,585	-1,425,402	-1,068,766	-854,389
10	-1,779,239	-1,151,065	- 845,225	-672,776
11	-2,136,625	-1,449,532	-1,101,202	-888,604
12	-2,167,779	-1,439,420	-1,068,484	-843,921
13	-2,222,418	-1,486,997	-1,117,923	-895,558
14	-2,270,126	-1,520,376	-1,141,424	-912,221
15	-1,890,578	-1,259,225	- 933,602	-735,272
16	-1,851,059	-1,174,233	- 841,233	-649,946
17	-2,213,614	-1,450,770	-1,070,203	-843,940
18	-2,082,696	-1,391,036	-1,048,293	-844,738
19	-2,257,509	-1,518,117	-1,140,803	-911,641
20	-1,922,300	-1,258,396	- 940,635	-758,170

Figure 14. Total Present Value for 20 Runs.
Case 4: Half Permanent Policy.

RUN	4%	8%	12%	16%
1	\$-1,756,498	\$- 719,038	\$ -335,827	\$ -178,307
2	-1,684,558	- 678,293	-316,422	-168,686
3	-1,862,860	-842,908	-451,514	-276,789
4	-1,758,090	-751,256	-364,326	-196,176
5	-1,717,290	-698,436	-320,063	-163,122
6	-1,714,391	-707,525	-332,568	-174,069
7	-1,780,442	-801,445	-426,211	-258,938
8	-1,700,578	-677,785	-300,272	-145,612
9	-1,712,196	-686,222	-312,786	-161,698
10	-1,851,966	-840,200	-441,081	-259,674
11	-1,761,913	-750,943	-372,068	-210,541
12	-1,731,758	-695,394	-318,507	-164,391
13	-1,735,845	-723,205	-345,690	-187,717
14	-1,704,610	-696,238	-327,256	-175,288
15	-1,757,892	-730,892	-342,753	-179,938
16	-1,776,294	-727,262	-328,534	-162,736
17	-1,727,292	-721,892	-347,334	-189,971
18	-1,705,031	-694,232	-328,081	-178,530
19	-1,756,532	-726,113	-339,986	-177,405
20	-1,786,343	-735,069	-343,341	-180,237

Figure 15. Total Present Value for 20 Runs.

Case 5: No Insurance.

Table 12. Average Total Present Value of 20 Runs.

Case	4%	8%	12%	16%
1	\$-2,662,586	\$-1,356,363	\$- 806,925	\$- 541,392
2	-2,095,249	-1,790,857	-1,521,984	-1,297,441
3	-2,161,831	-1,095,037	- 615,165	- 392,631
4	-2,054,900	-1,300,823	-1,020,481	- 813,339
5	-1,749,119	- 730,182	- 349,731	- 189,491

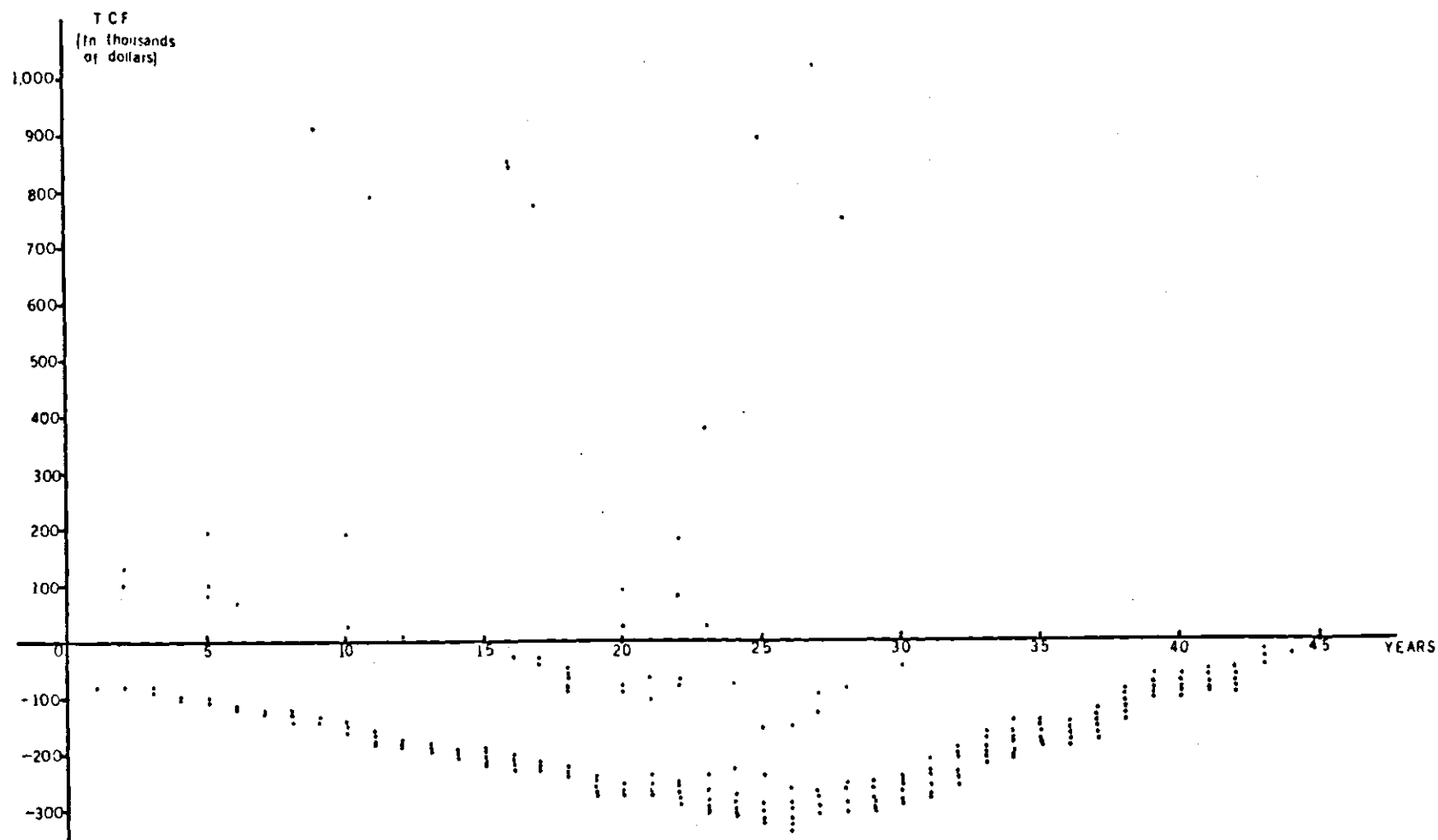


Figure 16. Pattern of Cash Flows. Case 1: Full Term Policy.

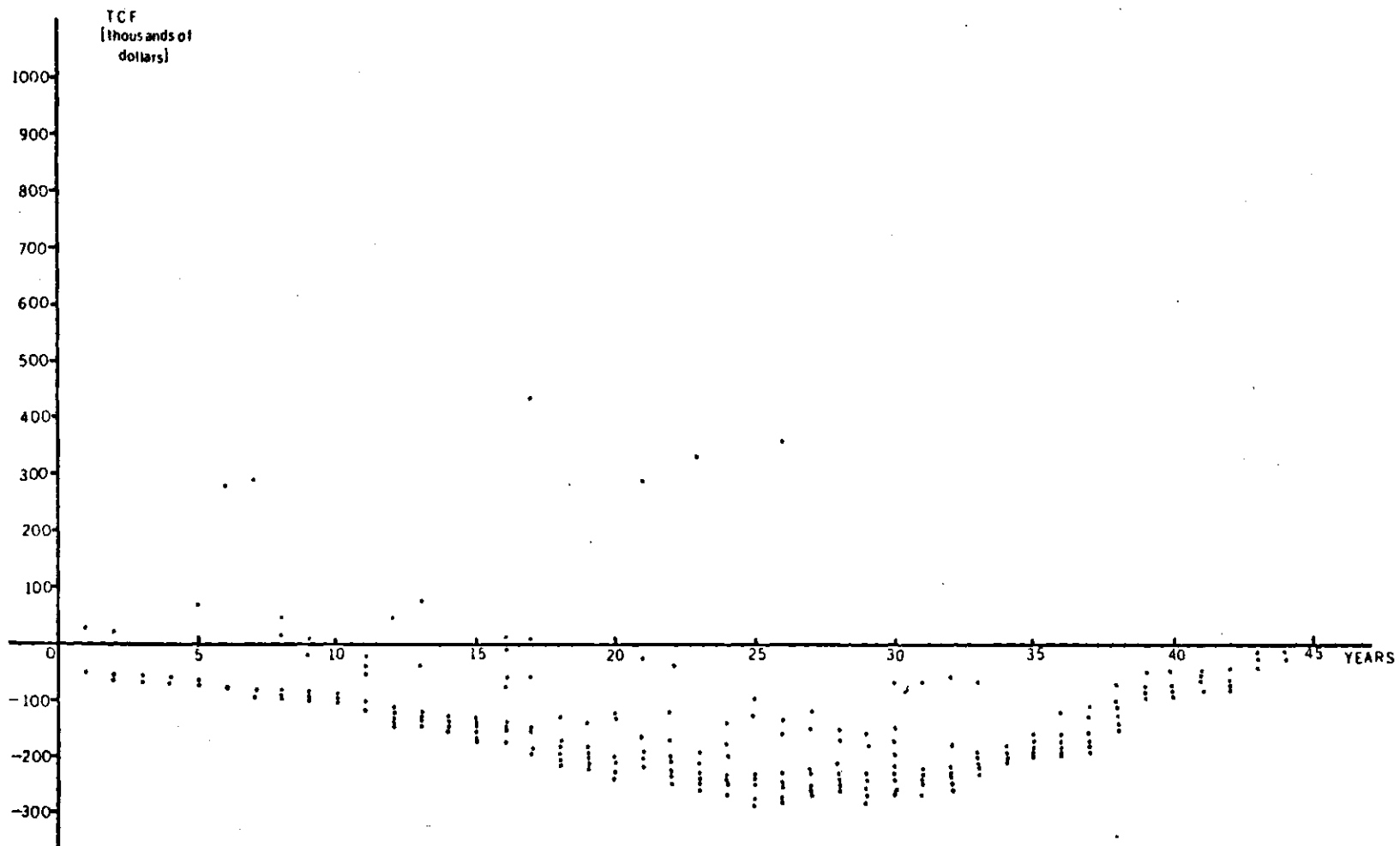


Figure 18. Pattern of Cash Flows. Case 3: Half Term Policy.

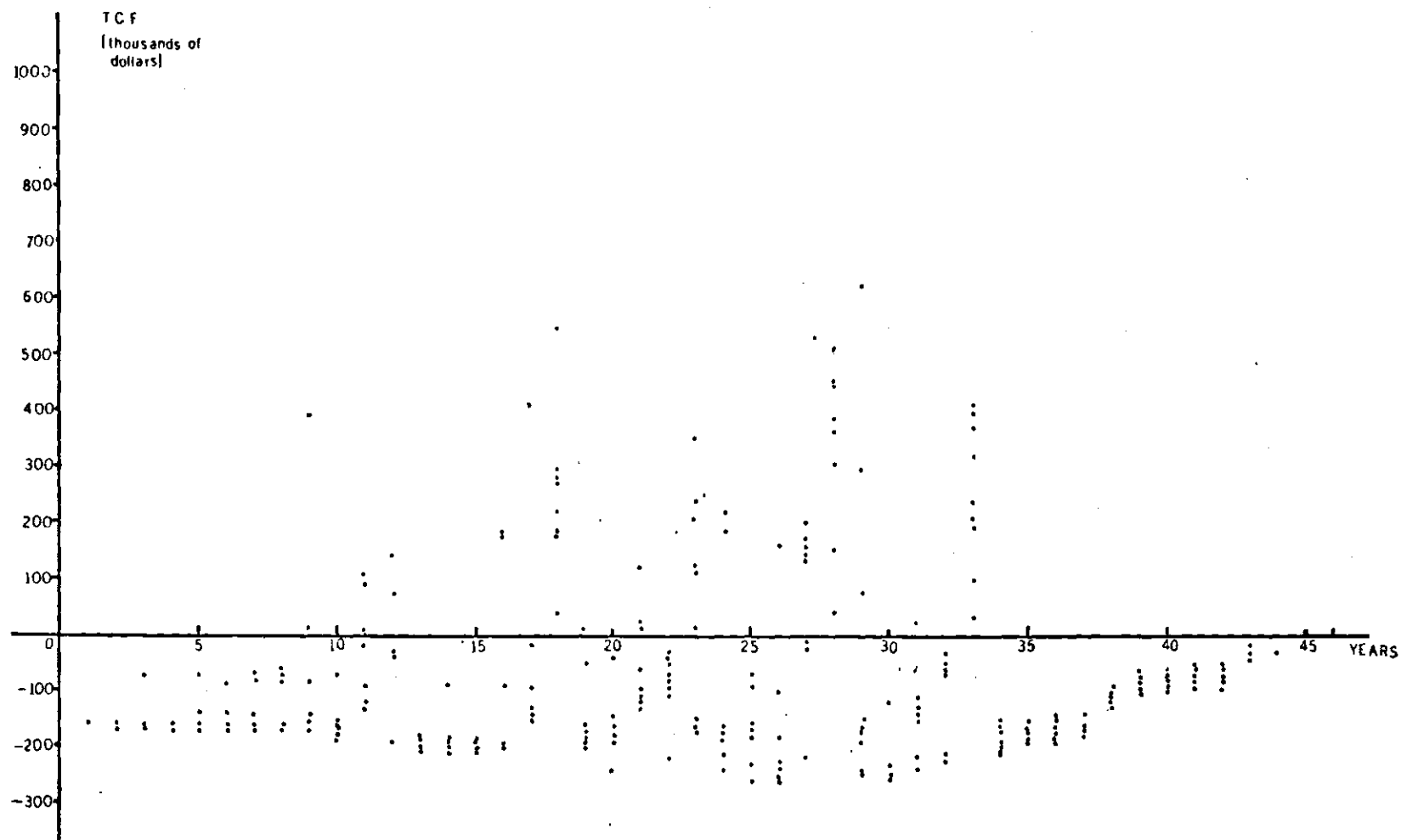


Figure 19. Pattern of Cash Flows. Case 4. Half Permanent Insurance.

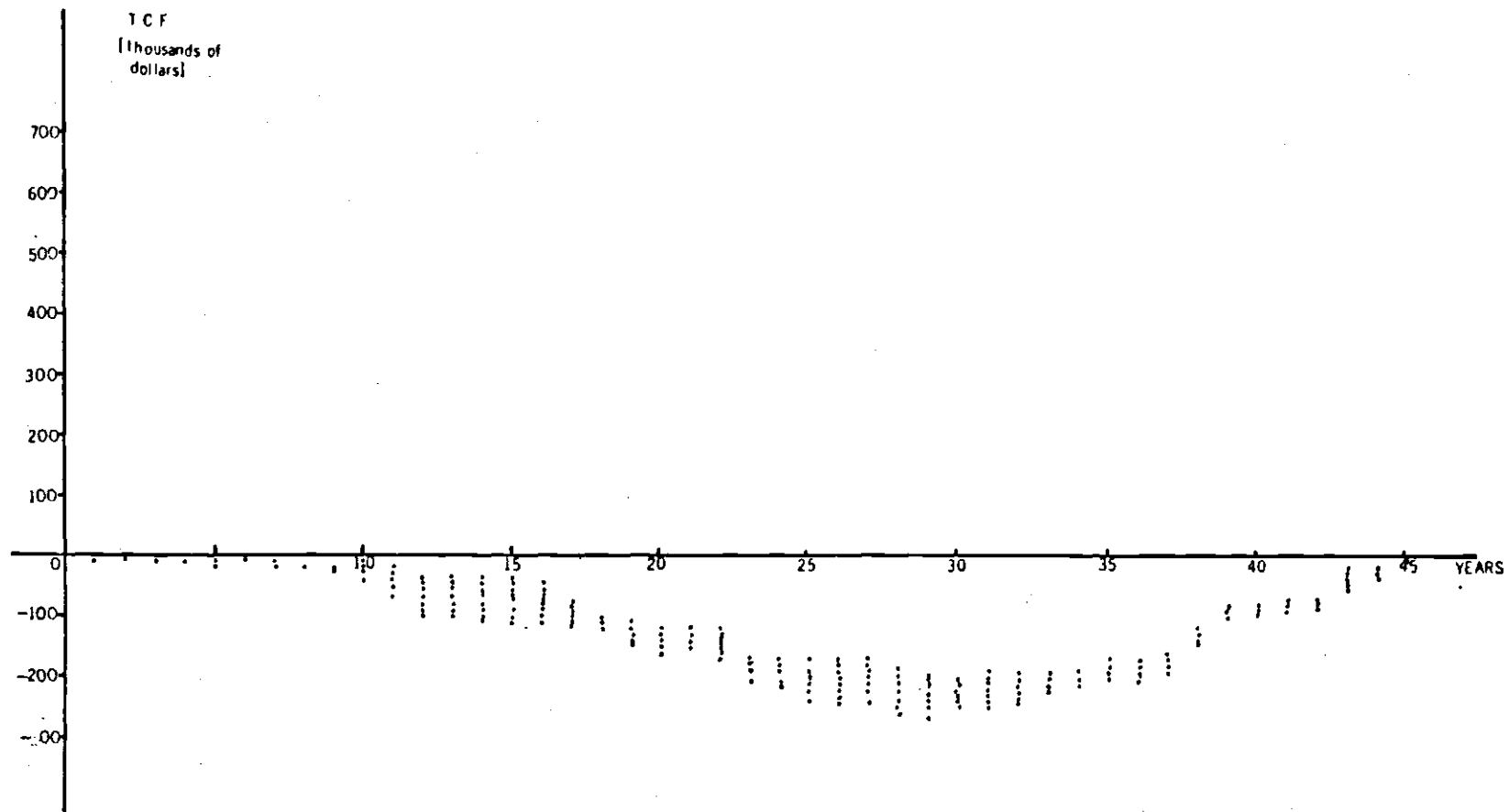


Figure 20. Pattern of Cash Flows. Case 5: No Insurance.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The choice of a funding method for a compensation plan is the purpose for developing the model presented in this thesis.

The selection as it was stated in the Introduction is going to be based on two criteria:

- 1) The expected present value of the cash flows after taxes for each method.
- 2) The pattern of possible cash flows to which the firm is exposed over the years for each method.

The average of the total present values of the cash flows over the period under study was presented in Table 12 for different discount rates.

Table 13 gives the order of favorability of each funding method based on the expected present values for each discount rate. The ranking of methods changes with the application of different discount rates. As the discount rate increases, methods with cash outflows concentrated in earlier years tend to become less favorable compared to methods in which cash outflows are longer deferred. It can be seen in Table 13 the importance of the time value of money. The decision of buying any insurance policy changes with the discount rate considered.

Table 13. Selection of Funding Method Using the Results
from Table 12.

4%	8%	12%	16%
No insurance	No insurance	No insurance	No insurance
Half Perm	Half Term	Half Term	Half Term
Full Perm	Half Perm	Full Term	Full Term
Half Term	Full Term	Half Perm	Half Perm
Full Term	Full Perm	Full Perm	Full Perm

For extremes values there is a switch in the decision; meanwhile there is consistency for intermediate rates. The lower cost of money induces the firm to buy the permanent policy meanwhile a 16% discount rate makes the term policy more acceptable.

The conclusion that can be reached based on this last Table is that the firm will be "better off" if it does not purchase any insurance. Paying death and retirement benefits without any funding method is cheaper for the firm than buying an insurance policy.

Considering the second criterion, Figures 16 through 29 show the pattern of cash flows over time. It can be observed that the cash outflows (negative flows) in each case tend to follow a less disperse pattern than the cash inflows (positive flows).

The outflows increase to a peak, then decrease to zero due to the fact that the entry of new personnel to the firm is not allowed in the model.

For the figures 16 & 18 the outflows increase reaching a peak in the years 26 & 25 respectively. This is because of the term policy's characteristics, which are premiums paid, increase through time.

The outflows in the Figures 17 and 19 correspond to the use of a permanent policy. Given that the premiums paid are constant, the pattern shown in the Figures is almost constant, points not contained in that pattern are the ones where death

benefits of the executive that died during that period did not offset all the costs of premiums paid.

Figure 20, the no insurance case is the one that shows the most uniform pattern of cash flows; the peak is reached at year 29 and begins to decrease rapidly to zero.

It can be seen too that after year 35 the behavior in all the cases is the same: there are just cash outflows originated by the youngest executives that did not die and the firm is just paying their retirement benefits.

Even though the cases 1,2,3, and 4 showed cash inflows, the case 5 seems to be the most effective because the largest outflow does not reach \$300,000 meanwhile for the other cases it goes over this value.

This reasoning supports the result obtained with the first criterion and the firm's decision will be not to purchase an insurance policy.

Recommendations

It must be realized that models can always be refined, reconstructed or disaggregated in all sectors.

There is a great potential in the field of the study of funding methods for compensation plans using simulation models. Recommendations can be made in two areas:

1. Based on the problem situation a recommendation for the firm of no purchasing insurance may not be altogether wise, even though it is shown in Figure 20 that during the first

years of simulation the outflows are small; a catastrophic situation could happen: for example, a group of executives could die at one time, and the firm would not be able to support these costs.

2. For further research the following suggestions are areas of interest:

a. Consider an annual increase in salary. This will change all the factors depending on salary as disability premiums, disability income, death and retirement benefits and possible consideration of an increase on the policy benefits to insure each executive.

b. Allow the entry of new people, and the resignation of executives, taking care of possible changes in mortality and disability tables.

c. Consider inflation. This fact will affect life-insurance policy holders in two ways:

- i) The cash surrender value or investment element of insurance policies may lose a substantial portion of the apparent value because of rising prices.
- ii) The face value of policies will like-wise decline in acquisition power and will, therefore, constitute less actual protection than was planned.
- iii) Premium rates would also increase on term policies.

Considering the importance of this fact, a possible firm's decision could be just to consider a term policy as

funding method because it does not involve any investment factor.

4. Purchase a "paid-up" policy, this means that at age 65 the permanent policy is not going to be "cashed in," the firm will stop paying premiums and it will wait until the executive will die to get the death proceeds. This assumption will extend the simulation period because of the need to simulate the process until all the executives will die.

Additional information on policies will be required.

APPENDIX A

THE PLAN AT THE XYZ CORPORATION: BASIC FACTORS

[2, p. 131]

The Plan at the XYZ Corporation: Basic Facts

Part A. Summary of Employee Data

	Number	Average Age	Average Service	Average Annual Pay
Active employees*				
Salaried males	1,446	42.9	14.8	\$14,874
Hourly males	1,454	44.2	16.3	8.445
Females	881	43.3	14.9	6,390

	Number	Average Monthly Pension
Terminated employees under 65 with vested benefits	142	\$ 77.82
Disabled employees	26	149.08
Retired employees & beneficiaries	699	122.85

Part B. Summary of Pension Plan Provisions

Participation: All full-time employees of the company hired prior to age 55.

Normal Retirement

1. Eligibility: Ten years of service
2. Normal retirement age: 65
3. Normal retirement benefit: 1.1% for each year of credited service multiplied by the "average final pay" in excess of "average Social Security wage base," plus \$5.00 per month for each year of credited service.
 - (a) Average final pay is the highest average pay over five consecutive years within the last ten years prior to retirement.
 - (b) Average Social Security wage base is the average base over the five years prior to retirement.

Early Retirement

1. Eligibility: Ten years of service
2. Early retirement age: 55 to 65

3. Early retirement benefit: Determined as for normal retirement, but based on credited service to date of early retirement and discounted by 5% per year for the number of years before age 65 that benefit payments are made.

Disability Retirement

1. Eligibility: Ten years of service.
2. Disability retirement age: 45 to 65
3. Disability benefit: Determined as for normal retirement, but based on credited service to date of disability retirement.
4. Definition of disability: Eligibility for Social Security Disability benefits.

Vesting on Termination of Employment

1. Eligibility: Ten years of service.
2. Vesting age: 45 to 55
3. Vested benefit: Determined as for normal retirement, but based on credited service to date of termination and computed as though age at termination were age at retirement. Vested benefits are payable starting at age 65.

Death Benefits

1. Eligibility: Ten or more years of credited service and age 55 or over.
2. Beneficiary: Spouse of active employee at time of death.
3. Death benefit: 40% of the benefit determined for normal retirement, based on credited service to date of death and computed as though age at death were age at retirement. Benefits are payable from date of death for the lifetime of the spouse but not beyond any date of remarriage.

APPENDIX B

FOUR REPRESENTATIVE COMPENSATION ARRANGEMENTS

[6, p. 120-121]

Four Representative Compensation Arrangements

Within each general type of arrangement, I have described the usual range of specific variations.

Current Renumeration

This category includes all compensation earned and received by the executive in one year.

Current Salary and Bonus: These are taxed at ordinary personal-tax rates and are deductible from corporate income. The payment may be in cash or company stock. (One should note that the Tax Reform Act limits the tax rate on items that meet its definition of "earned income" to 60% in 1971 and 50% thereafter.)

Fringe Benefits and Perquisites: These are usually nontaxable, so far as the executive is concerned, but they are deductible from corporate income as compensation expense. Company cars, expense accounts, physical examinations, and so on, fall under this heading.

Group Life Insurance Policies Below \$50,000 Face Value: The cost of the coverage is nontaxable for the employee and deductible by the corporation. Estate taxes are levied on the value of the insurance paid at death.

Group Life Insurance Policies in Excess of \$50,000 Face Value: The executive is taxed on the cost of the coverage, but the expense is still deductible for the corporation. Estate taxes, once again, are levied on the value of the insurance distributed at death.

Deferred Pay Plans

This category includes any arrangement by which the executive earns income in the current year but receives it in later years. He is usually taxed at lower rates if payment is deferred until his post-retirement years. Payment may be made in cash or stock or both.

Deferred Bonus: Here I have assumed that payment is spread over five years, beginning with the current year. Lump-sum payments distributed by reason of death are taxed as part

of the executive's estate. The company may deduct the payment in the year it is made.

Deferred Pay Contracts: Under these arrangements, payment is deferred for a number of years or until retirement. The executive is then taxed at ordinary income rates. I have assumed that distributions of unpaid amounts by reason of death will be included in the decedent's estate. Again, the company may deduct the payment in the year it is made. My analysis considers two deferral-payment combinations: (a) the company pays the executive a lump sum in the first year of his retirement; and (b) the company pays the executive in 10 annual installments, beginning with the first year of his retirement.

Tax-favored, Qualified Plans

Group plans that are nondiscriminatory in favor of highly paid employees may qualify for favorable tax treatment. Corporate contributions to these plans are deductible in the year they are made, but these contributions and the earnings they accrue are not taxable for the executive until the year he receives them. Plans in this category do not require employee contributions as a condition of participation.

Under prior tax law, the executive paid capital-gains rates on lump-sum distributions from these plans when he retired or separated from the company's service. The Tax Reform Act of 1969 removes a part of the capital-gains advantage by limiting capital-gains treatment to the difference between the taxable portion of the distribution and the company contributions; ordinary tax rates apply to that portion of the distribution that represents the corporate contribution. (One should also note that the Act also tightened the rules on capital gains. The capital-gains component may also be subject to the special tax on preference items. In addition, the marginal rate that applies may exceed the 25% maximum under prior tax law.

Benefit streams other than lump-sum distributions are taxed at ordinary income rates. The following distributions do not qualify as "earned income" under the maximum tax provision discussed earlier.

Qualified Pension Plan: Here the company usually purchases a guaranteed life annuity for the executive, to begin at his retirement and continue for 10 years. The company pays annual premiums to an insurance company until his retirement.

These premiums are deductible by the corporation in the year in which they are paid.

Qualified Profit-sharing Plan: The company contributes to a tax-free trust fund on the executive's behalf. The corporation can deduct these contributions in the year they are made. Payments to the executive are deferred, the period of deferral depending on the conditions of the plan. If the executive dies before receiving all the payments, the company distributes a lump sum, taxable at capital gains rates, to his beneficiary. I have taken four combinations of deferral periods and payment streams into account:

After five years of deferral, the company distributes a lump cash sum, which is taxable as ordinary income.

The company distributes five annual cash installments, beginning five years after deferral; ordinary tax rates apply.

The company distributes a lump cash sum in the first year of retirement; the executive pays capital gains as described in the general description of tax-favored plans.

The company distributes 10 annual cash installments, beginning in the first year of retirement, which are taxed as ordinary income when the executive receives them.

Equity-based Compensation

Plans that derive their value from price appreciation in shares of the company's common stock are subject to a variety of tax treatments. I have considered three such plans.

Qualified Stock Options: Favorable tax treatment is offered for stock-option plans designed in accordance with IRS rules. Price appreciation receives capital-gains treatment for the executive if he meets the holding-period requirements. The gain element may also be subject to the special tax on preference items under the Tax Reform Act. Here I have assumed that the executive exercises his option on its expiration date, at the end of a five-year holding period.

Nonqualified Stock Options: Price appreciation over the option period is taxable as ordinary income in the year of exercise, and a corresponding corporate deduction is also allowed. I have assumed that the option is exercised (a) at the end of the fifth year of the option, and, alternatively, (b) at the end of the tenth year of the option.

Restricted Stock Plans: Under prior tax law, discounted stock sold to the executive with significant restrictions attached was not taxed until these restrictions lapsed, and price appreciation during the restriction period qualified for capital-gains treatment at the point of later sale.

The Tax Reform Act completely changed the treatment of such plans. The executive is now taxed as soon as his interest in the stock becomes transferable or nonforfeitable. The tax itself is based on the difference between the market value of the shares when the restrictions lapse and the value of the stock when originally awarded to the executive.* Under the new law, an employee receiving restricted stock is given the option of having the value of the restricted shares taxed in the year the stock is received, even though it is subject to substantial restrictions. If he takes this option, any subsequent appreciation in the price of the shares would qualify for the more favorable capital-gains treatment.

In either case, the corporation may deduct an expense equal to the amount the executive reports as income, in the tax year he reports it. I have assumed a two-year restriction period, with the usual stipulation that the restrictions lapse in the event of the executive's death.

* A thorough analysis of this change written at the time the alternate method was first proposed, may be found in George W. Hettenhouse and Wilbur G. Lewellen, "The Taxation of Restricted Stock Compensation Plans," National Tax Journal, September 1969, p. 168.

APPENDIX C
VARIABLE DEFINITIONS

SEED=INITIALIZATION FOR THE RANDOM NUMBER GENERATOR.

IAGE(EXEC)=INITIAL AGE OF THE EXECUTIVE.

KAGE(EXEC,N)= ATTAINED AGE OF THE EXECUTIVE IN THE YEAR N.

CASE=INDICATES THE FUNDING METHOD USED TO GENERATE THE BENEFITS.

FACE(EXEC)= FACE AMOUNT OF THE POLICY USED TO INSURE THE EXECUTIVE.

PRLIFE(EXEC,N)= LIFE PREMIUM PAID BY THE FIRM FOR THE EXECUTIVE IN THE YEAR.

PRDIS(EXEC,N)= DISABILITY INCOME PREMIUM PAID IN THE YEAR N FOR THE EXECUTIVE.

NDEAT(EXEC)= YEAR WHEN THE EXECUTIVE DIED.

DB(EXEC,N)= DEATH BENEFITS THAT THE FIRM RECEIVES IN CASE OF EXECUTIVE'S DEATH.

CF(EXEC,N)= CASH FLOW THAT THE EXECUTIVE GENERATES IN THE PERIOD N.

PW(EXEC,N)= PRESENT VALUE OF THE CASH FLOW GENERATED BY THE EXECUTIVE IN THE YEAR N.

TCF(N)= TOTAL CASH FLOW FOR THE PERIOD N.

TPW(N)= TOTAL PRESENT VALUE FOR THE PERIOD N.

CV(EXEC)= CASH VALUE OF THE PERMANENT POLICY CONSIDERING \$1.000,000.FACE AMOUNT.

ND(EXEC)= YEAR IN WHICH THE EXECUTIVE BECOMES DISABLE.

DINC(EXEC,N)= DISABILITY INCOME OF THE EXECUTIVE IN THE YEAR N.

APPENDIX D
COMPUTER PROGRAM

```

      PROGRAM INSURE(DATA,CUTPUT,TAPE5=DATA,TAPE6=CUTPUT)
C     INSURE IS A PROGRAM THAT GIVES FOR EACH YEAR OF
C     SIMULATION THE CONDITION
C     OF EACH EXECUTIVE IN A GIVEN GROUP, THE CASH FLOWS
C     THAT HE GENERATES AND
C     THE TOTAL CASH FLOW FOR THE FIRM CONSIDERING ALL THE
C     EXECUTIVE'S GROUP.
C     IT ALSO GIVES AT THE END OF THE SIMULATION PERIOD THE
C     TOTAL PRESENT VALUE
C     OF THE FUNDING METHOD USED TO GENERATE THE CASH
C     REQUIRED TO PAY THE BENE-
C     FITS OFFERED FOR DIFFERENT VALUES OF INTEREST RATE.
      DIMENSION KAGE(50,50),SALARY(1000),STATUS(50,50),
      *   IAGE(100)
      DIMENSION CF(50,50),FK(50,50),PRLIFE(50,50),FRL(50,50)
      DIMENSION NOEAT(100),CCV(100),JL(5),ND(100)
      DIMENSION PROIS(50,50),PRD(50,50),DE(50,50),PAGE(100),
      *   C(100)
      DIMENSION TOTLFW(5),CV(50),CINC(50,50)
      DIMENSION TPW(100),TCF(100),FACE(100)
      INTEGER FLAG,STATUS,CASE,RTIME,TIME,DIS,EXEC,SEED
      DATA SEED/1111/
      CALL RANSET(SEED)
877  WRITE(6,879)SEED
879  FORMAT(1F1,750X,*SEEDCM=*,1I10/)
      DATA CV/647667.,934876.,445120.,813280.,756549.,
      *   899487.,832024.,
      *411551.,736097.,846135.,832024.,1082293.,1043091.,
      *   647667.,813280.,
      *934876.,899487.,756549.,934876.,970849.,1120229.,
      *   684157.,1120229.,
      *411551.,736097.,1120229.,899487.,1120229.,934876.,
      *   721164.,611903./
      DATA KAGE/48,38,54,43,45,39,41,55,44,42,41,34,35,48,
      *   43,38,39,45,38
      *,37,33,47,33,55,44,33,39,33,38,46,49,2469*0/
      DATA SALARY/105000.,100000.,75000.,65000.,32500.,
      *   36000.,32000.,
      *37500.,
      *32400.,33925.,42000.,45000.,34000.,40000.,40000.,
      *   38000.,47000.,
      *36500.,40000.,
      *38000.,36000.,36000.,45000.,44000.,37500.,55000.,
      *   57500.,40000.,
      *33000.,35000.,35000.,69*0.0/
      DATA FACE/1023750.,975000.,731250.,633750.,162500.,
      *   180000.,160000.
      *,187500.,
      *162300.,169625.,210000.,297000.,170000.,200000.,
      *   200000.,190000.,

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*310200.,
*182500.,200000.,190000.,180000.,180000.,297000.,
* 220000.,187500.,
*366300.,
* 379500.,200000.,165000.,175000.,175000.,69*0.0/
433 DO 143 J=1,4
143 TOTLPW(J)=0.
432 READ(5,8)CASE
8 FORMAT(1111)
WRITE(6,3344)CASE
3344 FORMAT(/50X,* CASE=*,111/)
N=1
EXEC=0
1 EXEC=EXEC+1
IF(EXEC.GT.31) GO TO 75
IF(N.GT.1) GO TO 2000
IAGE(EXEC)=KAGE(EXEC,1)
IF(CASE.EQ.1.OR.CASE.EQ.2) GO TO 301
IF(CASE.EQ.3) GO TO 302
IF(CASE.EQ.4) GO TO 301
IF(CASE.EQ.5) GO TO 309
GO TO 301
309 FLAG=1
GO TO 301
302 FACE(EXEC)=FACE(EXEC)*(0.5)
301 CONTINUE
RM=RAMF(MONO)
CALL MORTAL(IAGE(EXEC),KAGE(EXEC,N),FMCRT)
PM=FMCRT
IF(RM.LE.PM)GO TO 100
KIR=KANF(MONO)
RD=RAMF(MONO)
CALL DISAB(KAGE(EXEC,N),RL,KR)
LKR=KR
IF(LKR.EQ.2)GO TO 200
IF(KAGE(EXEC,N).GT.64)GO TO 700
900 STATUS(EXEC,N)=3
IF(FLAG.EQ.1)GO TO 303
800 CALL LIFEPR(N,CASE,IAGE(EXEC),KAGE(EXEC,N),
* SALARY(EXEC),FACE(EXEC)
*,PRL(EXEC,N))
PRLIFE(EXEC,N)=PRL(EXEC,N)
CALL DISAPR(IAGE(EXEC),SALARY(EXEC),N,EXEC,FRD(EXEC,N)
*
*DINC(EXEC,N)
PRDIS(EXEC,N)=PRD(EXEC,N)
F=0.
CF(EXEC,N)=F-PRLIFE(EXEC,N)-PRDIS(EXEC,N)
GO TO 1
100 STATUS(EXEC,N)=0

```

```

NDEAT(EXEC)=N
CALL DEATBE(IAGE(EXEC),KAGE(EXEC,N),CASE,FACE(EXEC),
* DEBEN)
IF(CASE.EQ.3) GO TO 111
IF(CASE.EQ.1.CR.CASE.EQ.2.CR.CASE.EQ.4) GO TO 118
118 CONTINUE
DB(EXEC,N)=DEBEN
GO TO 109
111 DB(EXEC,N)=(.5)*DEBEN
CONTINUE
109 CALL RETDEA(KAGE(EXEC,N),STATUS(EXEC,N),SALARY(EXEC),
* N,NDEAT(EXEC)
* ,COMF,KCCMP)
C(EXEC)=CMP
IF(FLAG.EQ.1) GO TO 115
116 CF(EXEC,N)=DB(EXEC,N)-(.52)*C(EXEC)
GO TO 1
115 DB(EXEC,N)=0.
GO TO 116
303 CF(EXEC,N)=0.
GO TO 11
11 FLAG=0
GO TO 1
200 MAGE(EXEC)=KAGE(EXEC,N)
ND(EXEC)=N
RM1=RANF(MCNO)
CALL MORTAL(IAGE(EXEC),KAGE(EXEC,N),FMCRT)
PM=FMCRT
IF(RM1.LT.PM) GO TO 100
GO TO 233
233 CALL RECCVT(KAGE(EXEC,N),ATF,TIME,DIS)
RTIME=TIME
IF(RTIME.GT.4) GO TO 599
STATUS(EXEC,N)=2
GO TO 600
599 STATUS(EXEC,N)=1
GO TO 600
600 IF(KAGE(EXEC,N).GT.64) GO TO 700
CALL LIFEPR(N,CASE,IAGE(EXEC),KAGE(EXEC,N),
* SALARY(EXEC),FACE(EXEC)
* ,PRL(EXEC,N))
PRLIFE(EXEC,N)=(.75)*PRL(EXEC,N)
CALL DISAPR(IAGE(EXEC),SALARY(EXEC),N,EXEC,PRD(EXEC,N)
* ,
* DINC(EXEC,N))
PRDIS(EXEC,N)=(.5)*PRD(EXEC,N)
IF(FLAG.EQ.1) GO TO 307
IF((KAGE(EXEC,N)-MAGE(EXEC)).LT.1) GO TO 304
IF(STATUS(EXEC,N).EQ.1) GO TO 305
IF(STATUS(EXEC,N).EQ.2) GO TO 310

```

```

310  CONTINUE
      IF((N-ND(EXEC)).GT.(RTIME-1))GO TO 900
      RM2=RANF(MCNO)
      CALL MORTAL(IAGE(EXEC),KAGE(EXEC,N),FMORT)
      PM2=FMORT
      IF(RM2.LT.PM2) GO TO 100
      STATUS(EXEC,N)=2
      GO TO 305
307  IF(STATUS(EXEC,N).EQ.1) GO TO 308
      IF(STATUS(EXEC,N).EQ.2) GO TO 311
311  CONTINUE
      IF((N-ND(EXEC)).GT.(RTIME-1)) GO TO 900
      RM3=RANF(MCNO)
      CALL MORTAL(IAGE(EXEC),KAGE(EXEC,N),FMORT)
      IF(RM3.LT.FMORT) GO TO 100
      STATUS(EXEC,N)=2
      GO TO 308
308  Z=0.
      CF(EXEC,N)=Z-(.52)*DINC(EXEC,N)
      GO TO 1
304  CF(EXEC,N)=- (PRLIFE(EXEC,N)+PRDIS(EXEC,N))
      GO TO 1
305  CF(EXEC,N)=0.
      GO TO 1
413  STATUS(EXEC,N)=0
      CALL RETDEA(KAGE(EXEC,N),STATUS(EXEC,N),SALARY(EXEC),
      * N,NDEAT(EXEC)
      * ,COMP,KCCMF)
      NCOMP=KCCMF
      C(EXEC)=COMP
      Z=0.
      CF(EXEC,N)=Z-C(EXEC)*( .52)
      GO TO 1
414  CF(EXEC,N)=0.
      GO TO 1
700  STATUS(EXEC,N)=4
      CALL RETDEA(KAGE(EXEC,N),STATUS(EXEC,N),SALARY(EXEC),
      * N,NDEAT(EXEC)
      * ,COMP,KCCMF)
      NCOMP=KCCMF
      C(EXEC)=COMP
      IF(KAGE(EXEC,N).EQ.65) GO TO 76
      IF(KAGE(EXEC,N).GT.65)GO TO 77
77  Z=0.
      CF(EXEC,N)=Z-C(EXEC)*( .52)
      GO TO 1
76  IF(CASE.EQ.5)GO TO 77
      IF(CASE.EQ.1)GO TO 77
      IF(CASE.EQ.3)GO TO 77
      IF(CASE.EQ.2.OR.CASE.EQ.4)GO TO 78

```

```

78      CONTINUE
      CCV(EXEC)=FACE(EXEC)*CV(EXEC)/1000000.
      CF(EXEC,N)=CCV(EXEC)-(1.52)*C(EXEC)
      GO TO 1
75      EXEC=0
      GO TO 1000
1000    CONTINUE
      CI=0.3
      CF0UR=.04
      DO 9595 MI=1,4
      JL(MI)=1
      CI=CI+CF0UR
      FACT=(1+CI)**(-N)
      DO 15 I=1,31
      FW(I,N)=CF(I,N)*FACT
15      CONTINUE
      SUM=0.
      DO 25 I=1,31
      SUM=SUM+FW(I,N)
25      CONTINUE
      TPW(N)=SUM
      INTRST=CI*25
142     TCTLPW(INTRST)=TCTLPW(INTRST)+TPW(N)
      ACUM=0.
      DO 17 I=1,31
      ACUM=ACUM+CF(I,N)
17      CONTINUE
      TCF(N)=ACUM
      WRITE(6,240)N,N,TCF(N),CI,N,TPW(N)
240     FORMAT(35X,*N=*,1I2,10X,*TCF(*I2*)=*,1F13.3,10X,*CI=*,
* F4.2,10X,
**TPW(*I2*)=*,F13.3)
9595    CONTINUE
      N=N+1
      WRITE(6,9596)
9596    FORMAT(/)
      DO 55 I=1,31
      KAGE(I,N)=IAGE(I)+N-1
55      CONTINUE
      GO TO 1
2000    CONTINUE
      IF(N.GT.46)GO TO 9999
      IF(CASE.EQ.5) GO TO 557
558     IF(STATUS(EXEC,(N-1)).EQ.0) GO TO 413
      IF(STATUS(EXEC,(N-1)).EQ.1) GO TO 600
      IF(STATUS(EXEC,(N-1)).EQ.2)GO TO 600
      IF(STATUS(EXEC,(N-1)).EQ.3)GO TO 301
      GO TO 700
557     FLAG=1
      GO TO 558

```

```
9999  CONTINUE
154   WRITE(6,93) ( INTRST,ICTLPW(INTRST),INTRST=1,4)
93    FORMAT(/,50X,'ICTLPW(*I1*)= ',1F15.3)
451   CONTINUE
      IF(CASE.NE.5) GO TO 433
876   STOP
      END
```

```

SUBROUTINE MORTAL(A,B,FMORT)
C   MORTAL IS A SUBROUTINE USED TO GET THE PROBABILITY OF
C   DEATH AT
C   A GIVEN AGE, THIS NUMBER IS CALLED FMORT.
      INTEGER A,B
      DIMENSION D(100),D6(100),D1(100),D2(100),D3(100),
      *   D4(100),D5(100)
      DATA D1/34*0.0,.92,1.18,1.50,1.74,1.99,2.27,2.61,2.94,
      *   3.34,
      *   3.83,4.37,4.94,5.46,6.22,7.26/
      DATA D3/44*0.0,2.15,2.97,3.82,4.56,5.22,5.97,6.90,
      *   7.60,8.35,
      *   9.25,10.44,11.84,13.70,15.70,17.82/
      DATA D4/49*0.0,3.23,4.58,6.13,7.21,7.91,9.48,11.38,
      *   12.1,13.08,
      *   14.45,15.84,17.70,20.24,22.88,25.08/
      DATA D5/54*0.0,4.34,6.34,8.72,10.5,11.55,13.3,15.56,
      *   17.1,18.69,
      *   21.16,23.89,27.21,30.66,34.85,38.62/
      DATA D2/39*0.0,1.52,2.64,2.49,2.96,3.32,3.91,4.36,
      *   4.86,5.40,
      *   6.1,6.92,7.72,8.74,9.77,10.65/
      DATA D/32*0.0,1.32,1.34,1.40,1.49,1.61,1.75,1.91,2.12,
      *   2.36,2.66,
      *   3.02,3.45,3.96,4.51,5.09,5.71,6.34,6.94,7.56,8.32,9.2,
      *   10.09,11.0,
      *   12.06,13.26,14.60,16.06,17.69,19.55,21.61,23.75,25.83,
      *   27.99,30.34,
      *   33.04,35.92,39.27,42.90,46.45,49.96,53.72,58.16,63.36,
      *   69.44,75.09,
      *   81.98,89.68,97.68,105.42,113.40,122.90,135.00,149.17,
      *   165.94,182.12
      *   ,196.71,213.26,229.66,246.98,262.03,276.79,302.02,
      *   338.33/
      DATA D6/29*0.0,.62,.76,.93,1.04,1.13,1.31,1.46,1.72,
      *   2.0,2.32,
      *   2.63,2.96,3.38,3.95,4.56/
      IF(A.GE.30.AND.A.LE.34)GO TO 650
      IF(A.GE.35.AND.A.LE.39)GO TO 651
      IF(A.GE.40.AND.A.LE.44)GO TO 652
      IF(A.GE.45.AND.A.LE.49)GO TO 653
      IF(A.GE.50.AND.A.LE.54)GO TO 654
      IF(A.GE.55.AND.A.LE.59)GO TO 655
655  CONTINUE
      IF(A.EG.B)GO TO 657
      IF((B-A).GT.14)GO TO 658
      FMORT=D5(B)/1000.
      GO TO 402
658  FMORT=D(B)/1000.
      GO TO 402

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```
657 FMORT=D5(B)/1000.  
GO TO 402  
650 IF(A.EQ.E)GO TO 6500  
IF((B-A).GT.14)GO TO 658  
FMORT=D6(B)/1000.  
GO TO 402  
6500 FMORT=D6(B)/1000.  
GO TO 402  
651 IF(A.EQ.E)GO TO 6510  
IF((B-A).GT.14)GO TO 658  
FMORT=D1(B)/1000.  
GO TO 402  
6510 FMORT=D1(B)/1000.  
GO TO 402  
652 IF(A.EQ.E)GO TO 6520  
IF((B-A).GT.14)GO TO 658  
FMORT=D2(B)/1000.  
GO TO 402  
6520 FMORT=D2(B)/1000.  
GO TO 402  
653 IF(A.EQ.E)GO TO 6530  
IF((B-A).GT.14)GO TO 658  
FMORT=D3(B)/1000.  
GO TO 402  
6530 FMORT=D3(B)/1000.  
GO TO 402  
654 IF(A.EQ.E)GO TO 6540  
IF((B-A).GT.14)GO TO 658  
FMORT=D4(B)/1000.  
GO TO 402  
6540 FMORT=D4(B)/1000.  
GO TO 402  
402 CONTINUE  
RETURN  
END
```

```

SUBROUTINE DISAB(LK,RC,KR)
C   DISAB IS A SUBROUTINE THAT CONTAINS THE PROBABILITIES
C   OF BECOMING
C   DISABLE IN A GIVEN PERIOD.IT COMPARES THE RANDOM
C   NUMBER WITH THE
C   CORRESPONDANT PROBABILITY TO DETERMINE IF THE
C   EXECUTIVE WILL BE DI-
C   SABLE OR NOT.
      DIMENSION XLI(50),XLF(50)
      DATA XLI/L.00077,0.00192,L.00392,C.00564,C.01033,
      * 0.01492/
      IF(LK.LT.40) GO TO 21
      IF(LK.GE.40.AND.LK.LE.44)GO TO 22
      IF(LK.GE.45.AND.LK.LE.49)GO TO 23
      IF(LK.GE.50.AND.LK.LE.54)GO TO 24
      IF(LK.GE.55.AND.LK.LE.59)GO TO 25
      IF(LK.GE.60.AND.LK.LE.64)GO TO 26
21    LAGE=1
      GO TO 10
22    LAGE=2
      GO TO 10
23    LAGE=3
      GO TO 10
24    LAGE=4
      GO TO 10
25    LAGE=5
      GO TO 10
26    LAGE=6
      GO TO 10
10    KR=0
      IF(RC.LE.XLI(LAGE))GO TO 33
      KR=1
      GO TO 37
33    KR=2
37    CONTINUE
      RETURN
      END

```



```

SUBROUTINE RETDEA(A,E,D,N,M,COMP,KCOMP)
C   RETDEA IS A SUBROUTINE THAT GIVES THE RETIREMENT AND
C   DEATH BENEFITS THAT THE COMPANY OFFERED: AMOUNT TO BE PAID AND
C   NUMBER OF YEARS.
      INTEGER A,E
      IF(D.GE.30000..AND.D.LT.45000.) GO TO 67
      IF(D.GE.45000..AND.D.LT.65000.) GO TO 68
      IF(D.GE.65000.) GO TO 66
66   CONTINUE
      KCOMP=15
      COMP=D*(.65)
      GO TO 69
67   KCOMP=10
      COMP=(.5)*D
      GO TO 69
68   KCOMP=12
      COMP=(.55)*D
69   CONTINUE
      IF(E.EQ.0) GO TO 81
      IF((A-64).GT.KCOMP) GO TO 82
      GO TO 83
82   COMP=0.
      KCOMP=0
      GO TO 83
81   IF((N-M+1).GT.KCOMP) GO TO 82
83   CONTINUE
      RETURN
      END

```

```

SUBROUTINE RECCVT(B,RTR,TIME,DIS)
C   RECVT IS A SUBROUTINE THAT GIVES THE REQUIRED TIME
C   FOR ANY EXECLT
C   VE TO RECOVER GIVEN THAT HE BECAME DISABLE IN A GIVEN
C   YEAR.
      INTEGER B,TIME
      DIMENSION VFA(40),VFB(40),VFC(40),VFD(40)
      DATA VFA/0.3142,0.6128,0.8459,0.9218/
      DATA VFB/0.2148,0.4292,0.5909,0.7079/
      DATA VFC/0.1328,0.2833,0.3929,0.4821/
      DATA VFD/0.1003,0.2199,0.3255,0.3895/
      IF(B.GE.30.AND.B.LE.39)GO TO 56
      IF(B.GE.40.AND.B.LE.49)GO TO 66
      IF(B.GE.50.AND.B.LE.59)GO TO 76
      IF(B.GE.60.AND.B.LE.64)GO TO 86
56   DIS=1
      IF(RTR.GT.VFA(4))GO TO 310
14   IF(RTR.GT.VFA(DIS))GO TO 13
      TIME=DIS
      GO TO 15
13   DIS=DIS+1
      GO TO 14
310  TIME=4
      GO TO 15
66   DIS=1
      IF(RTR.GT.VFB(4))GO TO 311
1114 IF(RTR.GT.VFB(DIS))GO TO 113
      TIME=DIS
      GO TO 15
113  DIS=DIS+1
      GO TO 1114
311  TIME=4
      GO TO 15
76   DIS=1
      IF(RTR.GT.VFC(4))GO TO 312
1144 IF(RTR.GT.VFC(DIS))GO TO 1133
      TIME=DIS
      GO TO 15
1133 DIS=DIS+1
      GO TO 1144
312  TIME=4
      GO TO 15
86   DIS=1
      IF(RTR.GT.VFD(4))GO TO 314
1145 IF(RTR.GT.VFD(DIS))GO TO 1134
      TIME=DIS
      GO TO 15
1134 DIS=DIS+1
      GO TO 1145
314  TIME=4

```

15 CONTINUE
 RETURN
 END

```

SUBROUTINE LIFEPR(N,CASE,A,E,C,D,XX)
C   LIFEPR IS A SUBROUTINE THAT GIVES THE LIFE PREMIUM
C   THAT THE FIRM
C   HAS TO PAY FOR EACH EXECUTIVE CONSIDERING THE POLICY
C   USED: TERM
C   OR PERMANENT.
      INTEGER CASE,A,B
      DIMENSION FACTCR(100),FACTCA(100),FACTOB(100)
      DIMENSION FACTC1(100),FACTC2(100)
      DATA FACTO2/31*0.0,3.45,3.55,3.65,3.78,3.94,4.13,4.36,
        * 4.63,4.94,
        * 5.27,5.63,6.01,6.42,6.86,7.39,7.95,8.58,9.30,10.1,
        * 10.95,11.9,13.03
        * ,14.31,15.77,17.41,19.21,21.28,23.54,22.95,24.79,
        * 26.80,29.00,31.39
        * ,32.03/
      DATA FACTO1/31*0.0,3.7,3.8,3.91,4.05,4.22,4.43,4.67,
        * 4.97,5.3,
        * 5.65,6.05,6.47,6.91,7.39,7.97,8.58,9.27,10.05,10.92,
        * 11.84,12.87,
        * 14.09,15.47,17.03,18.79,20.72,22.93,25.35,24.93,26.95,
        * 28.16,31.58
        * ,34.21,35.11/
      DATA FACTOR/31*0.1,2.96,3.04,3.13,3.25,3.40,3.59,3.81,
        * 4.09,4.40,
        * 4.74,5.11,5.51,5.93,6.39,6.95,7.54,8.21,8.97,9.82,
        * 10.72,11.73,
        * 12.93,14.29,15.83,17.59,19.52,21.73,24.15,23.73,25.75,
        * 27.96,31.38
        * ,33.01,33.91,34*0.0/
      DATA FACTOB/31*0.0,2.71,2.79,2.87,2.98,3.12,3.29,3.50,
        * 3.75,4.04,
        * 4.35,4.69,5.05,5.44,5.86,6.37,6.91,7.52,8.22,9.00,
        * 9.83,10.76,11.87
        * ,13.13,14.57,16.21,18.01,20.38,22.34,21.75,23.59,
        * 25.60,27.80,
        * 30.19
        * ,30.83/
      DATA FACTOA/31*0.0,20.30,20.96,21.65,22.38,23.15,
        * 23.98,24.82,25.72
        * ,26.66,27.65,28.70,29.80,30.96,32.19,33.48,34.85,
        * 36.30,37.82,
        * 39.44
        * ,41.15,42.95,44.87,46.90,49.06/
      IF(D.GT.64) GO TO 494
      J=8
      IF(CASE.EQ.1.OR.CASE.EQ.3)GO TO 4900
      IF(CASE.EQ.2.OR.CASE.EQ.4)GO TO 495
4900 IF(D.LT.100000.)GO TO 4090
      IF(D.GE.100000.) GO TO 490

```

```
490 IF(N.GE.1.AND.N.LE.3)GO TO 491
    IF(N.GE.4)GO TO 598
598 CONTINUE
    GO TO 497
495 XX=(D*FACTCA(A)/1000.)+10.
    GO TO 498
497 XX=(D*FACTOR(J)/1000.)+10.
    GO TO 498
491 XX=(D*FACTCB(J)/1000.)+10.
    GO TO 498
4090 IF(N.GE.1.AND.N.LE.3) GO TO 4091
    IF(N.GE.4)GO TO 5098
5098 CONTINUE
    GO TO 4097
4097 XX=(D*FACTC1(J)/1000.)+10.
    GO TO 498
4091 XX=(D*FACTC2(J)/1000.)+10.
    GO TO 498
494 XX=0.0
498 CONTINUE
    RETURN
END
```

```

SUBROUTINE DISAPR(A,C,N,EXEC,YY,AA)
C  DISABPR IS THE SUBROUTINE THAT GIVES THE DISABILITY
C  INCOME PREMIUM
C  TO BE PAID FOR EACH EXECUTIVE.
      INTEGER A,EXEC
      DIMENSION DIRATE(100)
      DATA DIRATE/31*0.0,29.49,30.65,31.87,33.16,34.52,
* 35.94,37.43,39.0
* ,40.68,42.41,44.23,46.15,48.10,50.16,53.38,55.43,
* 57.50,59.61,61.70
* ,63.81,65.86,67.85,69.62,70.99/
      IF(A.GT.64)GO TO 107
      IF(B.GE.30000..AND.B.LT.45000.)GO TO 307
      IF(B.GE.45000..AND.B.LT.65000.)GO TO 308
      IF(B.GE.65000.)GO TO 211
211  CONTINUE
      AA=(E/12.)*(0.65)
      GO TO 103
307  AA=(E/12.)*(0.5)
      GO TO 103
308  AA=(B/12.)*(0.55)
      GO TO 103
103  IF(AA.GT.3500.)GO TO 309
104  L=A
      DRATE=DIRATE(L)
      MDP=(AA*DRATE/100.)+10.
      YY=(MDP*.075)*12.
      GO TO 105
309  AA=3500.
      GO TO 104
107  YY=0.0
105  CONTINUE
      AA=AA*12.
      RETURN
      END

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*167411.21,167746.04,168081.53,168417.69/
 DATA AAF/180068.40,180142.23,180219.69,180302.59,
 * 180389.14,
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 * 182403.29,
 *182842.88,183376.78,184033.27,184822.77,185192.42,
 * 185562.80,
 *185933.93,186305.80,186678.41,187051.77/
 DATA AAG/180068.80,180142.43,180219.30,180299.41,
 * 180382.77,
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 * 181072.03,
 *181237.94,182008.24,182398.68,182872.89,183455.97,
 * 184157.20,
 *184485.51,184814.49,185144.11,185474.40,185805.35,
 * 186136.96/
 DATA AAG/187863.83,188318.38,188868.27,189544.42,
 * 190357.56,
 *190738.28,191119.76,191502.00,191885.00,192268.77,
 * 192653.31/
 DATA AAJ/182081.00,182165.28,182257.72,182356.69,
 * 182462.24,
 *182580.82,182714.14,182862.21,183029.96,183235.37,
 * 183495.02,
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 * 186313.63,
 *186646.28,186979.55,187331.51,187648.14,187983.43/
 DATA AAH/189703.03,189784.48,189869.38,189957.71,
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 *190158.32,190268.92,190393.22,190532.94,190688.13,
 * 190863.93,
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 * 195704.03,
 *196055.43/
 DATA AAG1/210090.03,210186.94,210287.83,210392.98,
 * 210502.38,
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 * 217158.15,
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 DATA AA0/175127.75,175271.35,175430.85,175611.55,
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 DATA AAL/175099.75,175206.56,175320.45,175448.43,
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 * 180195.30,
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 DATA AAQ1/223429.00,223960.23,224605.44,225398.79,
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 DATA AAB/297083.16,297169.31,297264.41,297365.48,
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 * 307279.09,
 *307893.65,308509.44,309126.46/
 DATA AAC/170049.30,170103.72,170161.55,170222.81,
 * 170287.49,
 *170357.31,170430.57,170508.96,170590.81,170676.10,
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 * 171489.74,
 *171675.38,171891.69,172159.85,172495.56,172911.27,
 * 173416.17,
 *174037.00,174783.62,175133.19,175483.45,175834.42,
 * 176186.09,
 *176538.46,176891.54/
 DATA AAN1/200130.00,200276.09,200440.32,200622.72,
 * 200829.36,
 *201082.41,201396.13,201788.82,202275.13,202865.77,
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 *204465.44,204874.37,205284.12,205694.69,206106.08,
 * 206518.29,
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 DATA AAI1/200096.00,200196.05,200300.15,200414.32,
 * 200536.57,
 *200666.92,200813.41,200978.08,201160.97,201368.16,
 * 201621.89,
 *201936.42,202330.19,202817.81,203410.04,204138.24,
 * 205014.00,
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 * 207486.50/

DATA AAE2/190068.4,190140.63,190218.58,190300.38,
 * 190387.92,
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 * 191022.79,
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 * 192231.27,
 *192606.12,193070.30,193634.06,194327.27,195160.94,
 * 195551.26,
 *195942.36,196334.25,196726.92,197120.37,197514.61/
 DATA AAF1/310317.88,310445.11,310578.60,310721.46,
 * 310870.61,
 *311026.05,311187.78,311365.16,311555.09,311757.60,
 * 311985.18,
 *312241.01,312525.15,312847.05,313241.24,313729.89,
 * 314341.67,
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 * 319786.57,
 *320426.14,3210066.99,321709.12,322352.54/
 DATA AAK1/182594.90,182698.98,182810.43,182929.25,
 * 183062.79,
 *183212.90,183379.63,183568.51,183799.80,184086.53,
 * 184445.50,
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 * 187640.39,
 *188015.67,188391.70,188768.48,189146.02/
 DATA AAE3/200072.00,200148.03,200230.09,200316.19,
 * 200408.33,
 *200504.53,200604.78,200709.10,200823.50,200946.00,
 * 201076.62,
 *201223.40,201388.41,201571.67,201779.29,202033.53,
 * 202348.70,
 *202743.28,203231.89,203825.33,204555.03,205432.57,
 * 205843.43,
 *206255.12,206667.63,207080.96,207495.13,207910.12/
 DATA AAD/190064.60,190133.02,190205.27,190283.26,
 * 190365.08,
 *190452.65,190544.06,190639.34,190738.47,190847.19,
 * 190963.61,
 *191087.73,191227.23,191384.03,191558.19,191755.50,
 * 191997.11,
 *192296.63,192671.60,193135.94,193699.90,194393.35,
 * 195227.29,
 *195617.75,196008.98,196401.00,196793.80,197187.39,
 * 197581.77/
 DATA AAA1/180048.60,180099.01,180151.24,180208.89,
 * 180270.16,
 *180335.06,180403.59,180477.55,180555.16,180638.31,
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 * 185908.22,
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 DATA AAM/180109.80,180226.87,180358.44,180506.33,
 * 180670.59,
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 * 182690.57,
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 * 185608.84,
 *185979.84,186351.80/
 DATA AAA2/297080.19,297163.37,297249.55,297344.67,
 * 297445.77,
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 * 306748.56,
 *307362.06,307976.78,308592.73,309209.92/
 DATA AAJ1/187691.30,187798.28,187912.84,188034.98,
 * 188172.25,
 *188326.55,188497.93,188692.08,188929.83,189224.56,
 * 189593.55,
 *190050.47,190605.42,191287.79,192108.41,192492.63,
 * 192877.61,
 *193263.37,193649.89,194037.19,194425.26/
 DATA AAA3/366398.90,366501.50,366607.78,366725.09,
 * 366849.78,
 *366981.85,367121.30,367271.82,367429.74,367598.76,
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 * 371881.64,
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 * 378323.22,
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 DATA AAF2/381684.0,381996.98,382344.60,382736.41,
 * 383220.66,
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 * 389668.01,
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 * 394367.47/
 DATA AAA4/200054.0,200110.02,200168.05,200232.10,
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 * 200805.47,

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 * 203047.58,
 *203536.92,204131.25,204862.04,205740.90,206152.38,
 * 206564.69,
 *206977.82,207391.77,207806.55,208222.17/
 DATA AAE4/165059.40,165122.12,165189.82,165260.85,
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 * 165888.21,
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 * 166937.68,
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 DATA BBB/1000000.,1000000.,1004233.,1009215.,1014945.,
 * 1021394.,
 *1028566.,
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 * 1113306.,
 *1131763.,
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 *1519984.14,1555831.86,1591679.57,1627257.28,1663375./
 DATA BBA/1000000.,1000000.,1004228.,1009232.,1014962.,
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 *1028568.,
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 * 1112874.,
 *131377.,
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 *1028549.,
 *1036450.,1045048.,1054313.,1069297.,1082165.,1096967.,
 * 1113628.,
 *1132169.,
 *1152523.,1174734.,1198727.,1224507.,1252044.,
 * 1284323.6,1316603.2,
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 * 1516679.5,
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 DATA BBD/1000000.,1000000.,1004336.,1009454.,1015332.,
 * 1021956.,

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*1029312.,
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*1135442.,
*1156256.,1178924.,1203466.,1229842.,1258084.,
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* 1514353.,1544712./
DATA BBZ/1000000.,1000000.,1004402.,1009583.,1015531.,
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*1029639.,
*1037776.,1046634.,1056188.,1071920.,1085248.,1100544.,
* 1117762.,
*1368800.,
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* 1325796.,
*1358278.,1390760.,1420094.25,1449428.5,1478762.,
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DATA BBF/1000000.,1000000.,1004456.,1009699.,1015693.,
* 1022435.,
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*1038150.,1047091.,1056735.,1072734.,1086179.,1101633.,
* 1119038.,
*1138333.,
*1159578.,1162751.,1207800.,1234780.,1263579.,
* 1295478.67,1327378.33
*,1359278.,1387487.5,1415697.,1443906.5,1472116./
DATA BBG/1000000.,1000000.,1004618.,1010044.,1016291.,
* 1023329.,
*1031134.,
*1039695.,1049034.,1059113.,1075892.,1089879.,1105854.,
* 1123834.,
*1143765.,
*1165664.,1189489.,1215230.,1242879.,1272432.,1303947.,
* 1329728.,
*1355509.,1381290.,1407071./
DATA BBH/1000000.,1000000.,1004735.,1010309.,1016731.,
* 1023973.,
*1032006.,
*1040852.,1050485.,1060899.,1078189.,1092589.,1108971.,
* 1127331.,
*1147666.,
*1169950.,1194204.,1220342.,1248440.,1278405.,1311577.,
* 1344749.,
*1377921.,1411759./
DATA BBI/1000000.,1000000.,1004836.,1010555.,1017132.,
* 1024571.,
*1032854.,
*1041960.,1051876.,1062597.,1080430.,1095199.,1111957.,
* 1130751.,

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*1151466.,
 *1174170.,1198812.,1225387.,1253887.,1284296.,1317081.,
 * 1349866.,
 *1382433.50/
 DATA BBJ/1000000.,1000000.,1004953.,1010800.,1017544.,
 * 1025184.,
 *1033679.,
 *1043035.,1053224.,1064257.,1082607.,1097718.,1114884.,
 * 1134038.,
 *1155147.,
 *1178217.,1203236.,1230186.,1259114.,1290027.,1306428.,
 * 1322829./
 DATA BBK/1000000.,1000000.,1005037.,1011007.,1017907.,
 * 1025712.,
 *1034426.,
 *1044022.,1054490.,1065824.,1084648.,1100191.,1117699.,
 * 1137201.,
 *1158668.,
 *182136.,1207510.,1234912.,1264222.,1295533.,1331703.2/
 DATA BBL/1000000.,1000000.,1005100.,1011144.,1018128.,
 * 1026036.,
 *1034857.,
 *1044580.,1055198.,1066703.,1085917.,1101706.,1119547.,
 * 1139372.,
 *1161243.,
 *1185127.,1211039.,1238892.,1268797.,1300732./
 DATA BBM/1000000.,1000000.,1005152.,1011275.,1018357.,
 * 1026369.,
 *1035307.,
 *1045171.,1055949.,1067637.,1087218.,1103248.,1121365.,
 * 1141579.,
 *1163819.,
 *1188129.,1214488.,1242879.,1273351./
 DATA BBN/1000000.,1000000.,1005192.,1011375.,1018533.,
 * 1026637.,
 *1035694.,
 *1045677.,1056612.,1068459.,1088402.,1104711.,1123997.,
 * 1143632.,
 *1165242.,
 *1190991.,1217784.,1246734./
 DATA BBC/1000000.,1000000.,1005249.,1011488.,1018721.,
 * 1026918.,
 *1035071.,
 *1046200.,1057270.,1069288.,1089585.,1106121.,1124818.,
 * 1145676.,
 *1168677.,
 *1193811.,1221111./
 DATA BBP/1000000.,1000000.,1005589.,1012543.,1020864.,
 * 1030520.,
 *1041517.,

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*1053830.,1067469.,1082426.,1106994.,1127032./
DATA BBQ/1000000.,1000000.,1005648.,1012763.,1021314.,
* 1031287.,
*1042670.,
*1055472.,1069622.,1085281.,1110780./
IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 233
IF(CASE.EQ.2.CR.CASE.EQ.4) GO TO 236
235 CONTINUE
M=B+1-A
IF(A.EQ.33) GO TO 130
IF(A.EQ.34) GO TO 131
IF(A.EQ.35) GO TO 132
IF(A.EQ.37) GO TO 133
IF(A.EQ.38) GO TO 134
IF(A.EQ.39) GO TO 135
IF(A.EQ.41) GO TO 136
IF(A.EQ.42) GO TO 137
IF(A.EQ.43) GO TO 138
IF(A.EQ.44) GO TO 139
IF(A.EQ.45) GO TO 140
IF(A.EQ.46) GO TO 141
IF(A.EQ.47) GO TO 142
IF(A.EQ.48) GO TO 143
IF(A.EQ.49) GO TO 144
IF(A.EQ.54) GO TO 145
IF(A.EQ.55) GO TO 146
233 IF(B.GT.65) GO TO 234
GO TO 235
234 DEBEN=0.0
GO TO 280
236 IF(B.GT.65) GO TO 234
GO TO 235
130 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 150
IF(CASE.EQ.5) GO TO 1501
GO TO 151
131 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 152
IF(CASE.EQ.5) GO TO 1501
GO TO 153
132 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 154
IF(CASE.EQ.5) GO TO 1501
GO TO 155
133 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 156
IF(CASE.EQ.5) GO TO 1501
GO TO 157
134 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 158
IF(CASE.EQ.5) GO TO 1501
GO TO 159
135 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TO 160
IF(CASE.EQ.5) GO TO 1501
GO TO 161

```

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136 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 162
    IF(CASE.EQ.5) GO TO 1501
    GO TC 163
137 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 164
    IF(CASE.EQ.5) GO TO 1501
    GO TO 165
138 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 166
    IF(CASE.EQ.5) GO TO 1501
    GO TC 167
139 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 168
    IF(CASE.EQ.5) GO TO 1501
    GO TC 169
140 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 170
    IF(CASE.EQ.5) GO TO 1501
    GO TC 171
141 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 172
    IF(CASE.EQ.5) GO TO 1501
    GO TC 173
142 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 174
    IF(CASE.EQ.5) GO TO 1501
    GO TC 175
143 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 176
    IF(CASE.EQ.5) GO TO 1501
    GO TC 177
144 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 178
    IF(CASE.EQ.5) GO TO 1501
    GO TC 179
145 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 180
    IF(CASE.EQ.5) GO TO 1501
    GO TC 181
146 IF(CASE.EQ.1.CR.CASE.EQ.3) GO TC 182
    IF(CASE.EQ.5) GO TO 1501
    GO TC 183
150 IF(D.EQ.180000.CR.D.EQ.900000.) GO TO 1511
    IF(D.EQ.297000.CR.D.EQ.148500.) GO TO 1512
    IF(D.EQ.366300.CR.D.EQ.183150.) GO TO 1513
    DEBEN=AAA4(M)
    GO TC 280
1511 DEBEN=AAA1(M)
    GO TC 280
1512 DEBEN=AAA2(M)
    GO TC 280
1513 DEBEN=AAA3(M)
    GO TC 280
151 DEBEN=(D/1000000.)*EBA(M)
    GO TC 280
152 DEBEN=AAE(M)
    GO TC 280
153 DEBEN=(D/1000000.)*BEB(M)
    GO TC 280

```



```

154  DEBEN=AAE(M)
      GO TO 280
155  DEBEN=(D/1000000.)*EEC(M)
      GO TO 280
156  DEBEN=AAE(M)
      GO TO 280
157  DEBEN=(D/1000000.)*EED(M)
      GO TO 280
158  IF(D.EQ.975000.CR.D.EG.487500.) GO TO 1522
      IF(D.EQ.190000.CR.D.EG.95000.) GO TO 1523
      IF(D.EQ.200000.CR.D.EG.100000.) GO TO 1524
      DEBEN=AAE4(M)
      GO TO 280
1522 DEBEN=AAE1(M)
      GO TO 280
1523 DEBEN=AAE2(M)
      GO TO 280
1524 DEBEN=AAE3(M)
      GO TO 280
159  DEBEN=(D/1000000.)*EEE(M)
      GO TO 280
160  IF(D.EQ.180000.CR.D.EG.90000.) GO TO 1532
      IF(D.EQ.310200.CR.D.EG.155000.) GO TO 1533
      DEBEN=AAF2(M)
      GO TO 280
1532 DEBEN=AAF(M)
      GO TO 280
1533 DEBEN=AAF1(M)
      GO TO 280
161  DEBEN=(D/1000000.)*BBF(M)
      GO TO 280
162  IF(D.EG.160000.CR.D.EG.80000.) GOTC 1542
      DEBEN=AAE1(M)
      GO TO 280
1542 DEBEN=AAE(M)
      GO TO 280
163  DEBEN=(D/1000000.)*BEG(M)
      GO TO 280
164  DEBEN=AAE(M)
      GO TO 280
165  DEBEN=(D/1000000.)*BEF(M)
      GO TO 280
166  IF(D.EG.833750.CR.D.EG.366875.) GO TO 1555
      DEBEN=AAI1(M)
      GO TO 280
1555 DEBEN=AAI(M)
      GO TO 280
168  IF(D.EG.162000.CR.D.EG.81000.) GO TO 1552
      DEBEN=AAJ1(M)
      GO TO 280

```

```

1552  DEBEN=AAJ(M)
      GO TO 280
167   DEBEN=(C/1000000.)*BEI(M)
      GO TO 280
169   DEBEN=(D/1000000.)*BEJ(M)
      GO TO 280
170   IF(D.EQ.162500.CR.D.EQ.81250.) GO TO 1562
      DEBEN=AAK1(M)
      GO TO 280
1562  DEBEN=AAK(M)
      GO TO 280
171   DEBEN=(D/1000000.)*BEK(M)
      GO TO 280
172   DEBEN=AAL(M)
      GO TO 280
173   DEBEN=(C/1000000.)*BEL(M)
      GO TO 280
174   DEBEN=AAP(M)
      GO TO 280
175   DEBEN=(D/1000000.)*BEP(M)
      GO TO 280
176   CONTINUE
      F=D
      IF(F.EQ.1023750.CR.D.EQ.511875.) GO TO 933
      DEBEN=AAN1(M)
      GO TO 280
933   DEBEN=AAN(M)
      GO TO 280
177   DEBEN=(D/1000000.)*BEN(M)
      GO TO 280
178   DEBEN=AAC(M)
      GO TO 280
179   DEBEN=(D/1000000.)*BEC(M)
      GO TO 280
180   DEBEN=AAF(M)
      GO TO 280
181   DEBEN=(D/1000000.)*BEF(M)
      GO TO 280
182   IF(D.EQ.187500.CR.D.EQ.93750.) GO TO 1634
      DEBEN=AAG(M)
      GO TO 280
1634  DEBEN=AAG1(M)
      GO TO 280
183   DEBEN=(D/1000000.)*BEG(M)
      GO TO 280
1501  DEBEN=0.0
      GO TO 280
280   CONTINUE
      RETURN
      END

```

APPENDIX E

TERMFA: COMPUTER PROGRAM TO GET DEATH
PROCEEDS FOR TERM POLICIES

```

PROGRAM TERMFA(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
DIMENSION DIVTER(70),TDEBEN(70)
DATA DIVTER/32*0.0,.27,.28,.29,.32,.34,.36,.38,.41,
* .43,.46,.48,
* .50,.52,.57,.61,.65,.73,.82,.91,1.03,1.26,1.56,1.95,
* 2.41,2.92,
* 3.53,4.29,2.00,15*2.00/
K=1
54 READ(5,53) IAGE,FACE
WRITE(6,633) IAGE,FACE
633 FORMAT(/,1X,* IAGE=*,112,10X,* FACE=*,1F10.2,/)
53 FORMAT(112,F10.2)
K=K+1
IF(K.GT.31) GO TO 59
KAGE=IAGE
TDEBEN(KAGE)=FACE*(1+(DIVTER(KAGE)/1000.))
52 WRITE(6,55) KAGE,TDEBEN(KAGE)
55 FORMAT(1X,*KAGE=*,112,10X,*TDEBEN=*,1F10.2)
KAGE=KAGE+1
IF(KAGE.GT.66) GO TO 54
M=KAGE-1
GO TO 57
57 TDEBEN(KAGE)=TDEBEN(M)*(1+(DIVTER(KAGE)/1000.))
GO TO 52
59 CONTINUE
STOP
END

```

The definition of each variable used in the program is given below:

IAGE : initial age of the executive.

FACE : face amount of executive's policy.

KAGE : attained executive's age.

TDEBEN: death proceeds for the Term Policy.

A sample of program's output is shown for Executives 3 and 23.

Executive 3.

IAG*=54	FACE= 731250.00
KAGE*54	TDEBEN= 732390.75
KAGE*55	TDEBEN= 733618.91
KAGE*56	TDEBEN= 735587.42
KAGE*57	TDEBEN= 737735.33
KAGE*58	TDEBEN= 740376.42
KAGE*59	TDEBEN= 743552.64
KAGE*60	TDEBEN= 746939.74
KAGE*61	TDEBEN= 746529.82
KAGE*62	TDEBEN= 748024.88
KAGE*63	TDEBEN= 749518.93
KAGE*64	TDEBEN= 751017.97
KAGE*65	TDEBEN= 752520.00
KAGE*66	TDEBEN= 754025.04

Executive 23.

IAQ*=33	FACE= 297000.00
KAGE*33	TDEBEN= 297080.19
KAGE*34	TDEBEN= 297163.37
KAGE*35	TDEBEN= 297249.55
KAGE*36	TDEBEN= 297344.67
KAGE*37	TDEBEN= 297445.77
KAGE*38	TDEBEN= 297552.85
KAGE*39	TDEBEN= 297665.92
KAGE*40	TDEBEN= 297787.96
KAGE*41	TDEBEN= 297916.01
KAGE*42	TDEBEN= 298053.05
KAGE*43	TDEBEN= 298196.12
KAGE*44	TDEBEN= 298345.21
KAGE*45	TDEBEN= 298500.35
KAGE*46	TDEBEN= 298670.50
KAGE*47	TDEBEN= 298852.69
KAGE*48	TDEBEN= 299046.94
KAGE*49	TDEBEN= 299265.25
KAGE*50	TDEBEN= 299510.64
KAGE*51	TDEBEN= 299783.20
KAGE*52	TDEBEN= 300091.98
KAGE*53	TDEBEN= 300447.09
KAGE*54	TDEBEN= 300853.82
KAGE*55	TDEBEN= 301325.66
KAGE*56	TDEBEN= 301852.33
KAGE*57	TDEBEN= 302434.91
KAGE*58	TDEBEN= 303070.13
KAGE*59	TDEBEN= 303765.24
KAGE*60	TDEBEN= 304516.29
KAGE*61	TDEBEN= 305328.56
KAGE*62	TDEBEN= 306206.66
KAGE*63	TDEBEN= 307156.78
KAGE*64	TDEBEN= 308182.73
KAGE*65	TDEBEN= 309289.92
KAGE*66	TDEBEN= 310482.34

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